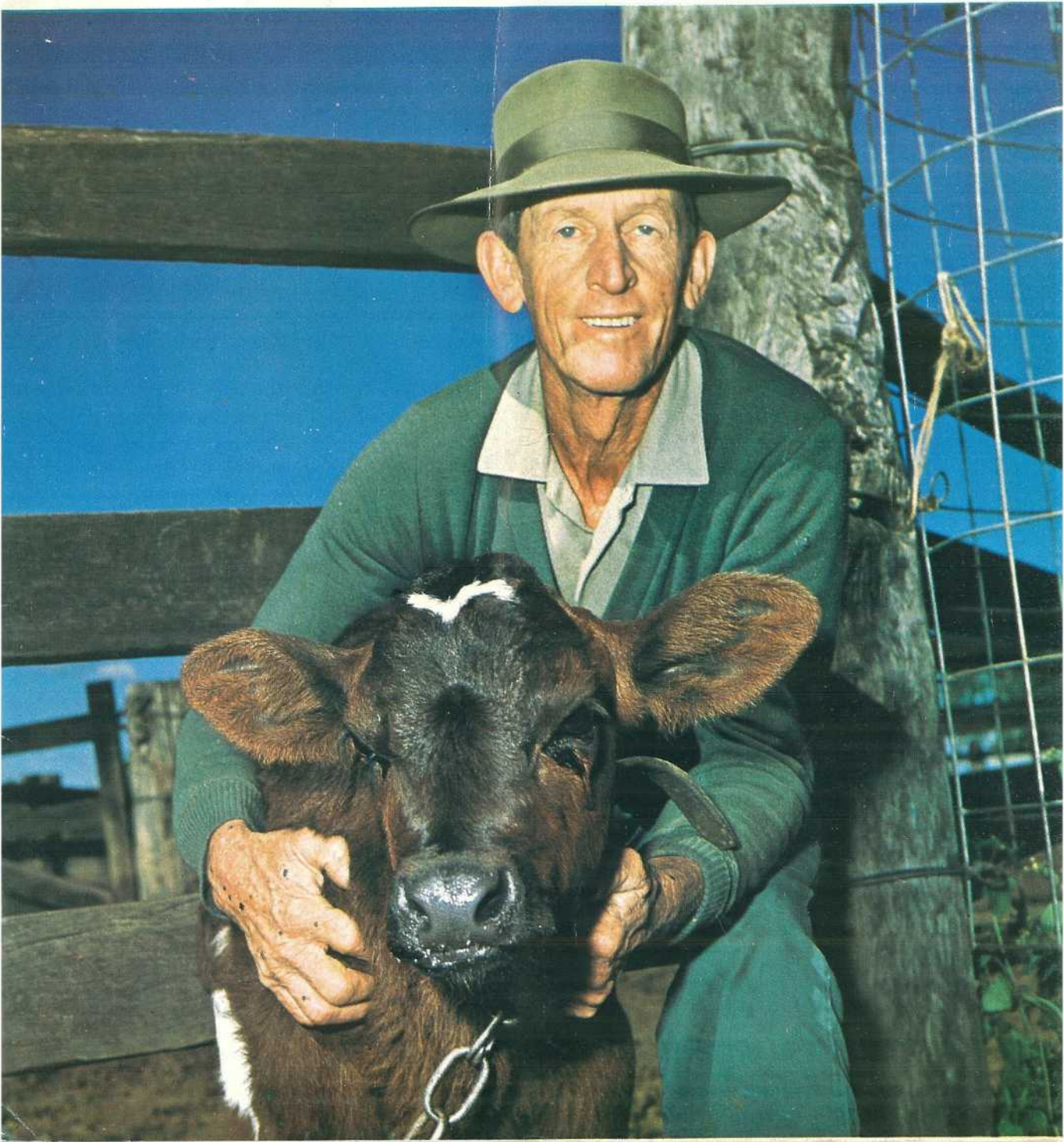
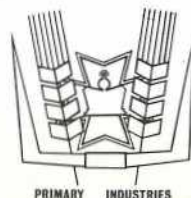


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*Mr. George Teese, of Innisplain, Beaudesert, uses A.I. to breed replacements for his dairy herd. He is a foundation member of the Beaudesert and District Artificial Breeding Group which was set up in the late 1950s.*

Editor: A. E. FISHER

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## Pasture Subsidy now \$3.8m

DAIRY Pasture Subsidy Scheme payments topped the \$3.8 million mark in June, when approvals under the 8-year-old scheme covered 127 890 hectares throughout Queensland.

Announcing this, the Minister for Primary Industries (Hon. V. B. Sullivan, M.L.A.) said that, since the introduction of the scheme by the State Government in mid 1966 as a dairy industry assistance measure, the scheme had attracted 23 273 applications to 27 June 1974.

In the first 7 years, applications had held to an average of around 3 000 but, in the current year, the total had declined to 1 824.

'The fall-off was most marked in districts which have made good use of the scheme in previous years, particularly in north Queensland and Wide Bay,' Mr. Sullivan said.

'However, keen interest has been maintained this year in the West Moreton and on the Darling Downs, where acceptance was slow in the initial years.

'It appears that farmers in these areas are taking advantage of improved seasonal conditions following a comparatively dry period.'

Mr. Sullivan said that the peak year for payments was 1971-72 when subsidy of \$623 059 was approved.

The scheme now had progressed to the stage where 136 dairy farmers had received the maximum subsidy of \$2 000.

The Malanda (Atherton Tableland) district led with 38, followed by Gympie East, Gympie West and Beaudesert with 10 each.

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# Trees and Shrubs in Mulga

IN the mulga lands of semi-arid and arid Australia domestic stock can be maintained for long periods on the leaves (phyllodes) of felled mulga trees.

Dry sheep have commonly survived on such diet for well over 12 months. Because of the value of mulga, along with other palatable shrubs such as wilga and berrigan, woody plants are usually regarded more highly in these areas than they are in coastal and sub-coastal districts.

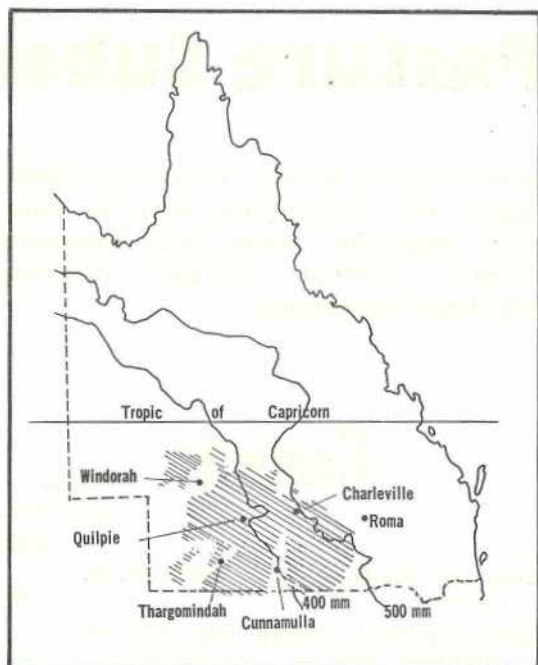
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by W. H. BURROWS, Agrostologist.

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The Queensland, mulga lands (22 million hectares) are confined to the south-west of the State, occupying much of the region bounded by Morven-Bollon in the east and Augathella-Windorah in the north. Research and management aim at obtaining a balance between the number of trees necessary to provide adequate drought reserves, but at the same time necessary to permit sufficient grass growth for animal production in non-drought periods.

Woody plants also have undesirable features that must be taken into account when evaluating their place in property management. It should be considered whether the contribution of fodder by trees and shrubs matches the proportion of available soil moisture used by them, and, if not, whether practical measures to change the situation are feasible.



*Distribution of mulga in Queensland (after a map by S. T. Blake, 1938). (Figure 1).*

Moreover, apart from fodder trees, the woody plants found on mulga lands are unpalatable or even poisonous to stock, and some of these plants are increasing in density. Turkey bushes, cassias and false sandalwood are examples.

## Mulga

In arid south-west Queensland where annual rainfall is less than the 400 mm, mulga trees are mostly scattered in open stands but at times tend to clump together in groves. Where



# Lands

rainfall is higher, they occur as semi-arid forest formations, particularly east of the Warrego River. On these forest sites, one of the aims of management should be to reduce mulga densities to improve grass growth. Research along these lines has been undertaken at 'Boatman' (140 km south-east of Charleville), 'Monamby' (110 km west south-west of Charleville) since 1965, and at Charleville since 1970.

At these experimental sites, which are protected from grazing, mulga forests were thinned to 40, 160 and 640 trees a hectare and response in both the mulga leaf and ground forage production recorded. These responses are also being measured at Charleville in both fully cleared and undisturbed forest.

Not unexpectedly, as tree numbers increase, grass and herbage production decrease. At Monamby, after 7 years, it was found that most mulga regeneration was occurring in the plots with the fewest standing trees (Figure 2). A clearer picture of the initial seedling response is shown by seedling numbers from the Charleville site only 18 months after thinning.

Cleared or thinned mulga forest has the capacity to revert quickly to mulga scrub, unless management designed to prevent this is implemented. On a practical scale, Mr. Jack Brayley, of 'Wongalee', Wyandra, and Mr. Colin Starkey, of 'Arabella', Charleville, have kept mulga regrowth in check by strategic heavy stocking with sheep.

Native grasses have responded well to scrub clearing. However, wire grasses have tended to predominate. In these situations, management strategies to avoid vegetable fault in wool may have to be adopted if optimum utilization of this induced grassland is to be attained.



*Effect of mulga tree density on herbage production at Boatman Station—top, 16 trees per hectare; centre, 160 trees per hectare; bottom, 640 trees per hectare (plate 1).*

Although mulga is readily killed by fire, caution must be exercised in using fire as a control technique. Mulga soils are very

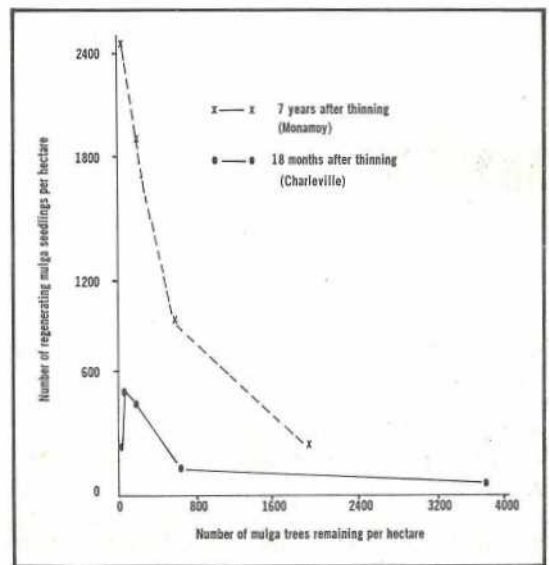
infertile, and the nutrients incorporated in the organic matter form a significant part of those available in the soil-plant-animal system. Following fire, the nutrients can be lost from the system by wind and water erosion of light ash. In addition, fire removes the plant litter which helps to maintain soil moisture and provides favourable sites for grass seed germination.

Another aspect of the mulga studies is also worth mentioning. While mulga regenerates best in years with above-average summer rainfall, good regeneration occurred in protected plots between 1965 and 1971 when summer rains were well below normal. Early spring and autumn rainfall, particularly, resulted in mulga regeneration. It is clear that mulga can germinate and establish in most years, but heavy stocking rates can prevent this, except when summer (grass) rains provide plentiful alternative feed for sheep.

The findings may be summarized as follows:—

#### A. IN MULGA FORESTS

1. Although maximum grass growth results where all the trees are removed, large areas of mulga should not be cleared 'on a face'. Instead, regular strips of forest at least 40 m wide should be left as shade and fire breaks.



▲ Seedling regeneration in artificially thinned mulga scrubs (adapted from Burrows, W. H. (1973) *Tropical Grassland* 7, No. 1, p. 57). (Figure 2).

▼ Cleared mulga country (foreground) on 'Wongalee' Station. Note the grass growth (plate 2).





2. Mulga seedlings regenerating in the cleared sites can be kept in check by strategic heavy grazing with sheep during the dry winter months. The seedlings should not be allowed to grow out of the reach of sheep.

3. To encourage regeneration in areas maintained for drought feeding:—

Retain at least 40 'seed' trees per hectare when pushing for drought feed.

Lightly stock the area (fewer than 1 sheep to 5 hectares) until the leader shoots of regenerating seedlings are out of the reach of sheep.

#### B. IN AREAS WHERE MULGA TREE RESERVES ARE DEPLETED

1. Viable mulga seed does not last in the soil for much more than 2 years. Consequently, if all seed trees have been removed for longer than this period, significant regeneration cannot be expected.

2. Where mature seed trees are present, regeneration will be promoted when litter (fallen branches, plant debris) is left on the soil surface.

3. A fire is not necessary before mulga seed will germinate.

4. Regeneration is most spectacular after heavy summer rain (spread over more than 3 days), but will occur in most years if stocking rates are kept low (fewer than 1 sheep to 5 hectares).

#### Green Turkey Bush

Green (or Charleville) turkey bush is a woody shrub up to 1.5 m high, which occurs in dense patches on better-watered slopes of the Warrego and Paroo River catchments.

Although the bushes are lightly browsed during prolonged droughts, they are regarded as a serious pest because they compete strongly with grasses and other useful plants. Moreover, in recent years, the stands have increased rapidly in density where stocking rates were low and in sites completely protected from domestic stock.

Areas carrying stands of green turkey bush are valued by graziers at less than \$2.50 per hectare; so, to be acceptable, control measures must be inexpensive. In addition, successful

control should aim not only at killing the plants, but also at ensuring that they are replaced with more useful species.

Because of the cost, mechanical and chemical treatments have only limited application. However, these measures may be of use in preventing invasion of areas cleared of mulga scrub, and in removing plants from holding paddocks and yards.

In trials at Charleville, either ploughing out stands of green turkey bush or slashing at ground level was found to be an effective means of killing the plant. Many of the common herbicides applied as high volume sprays will also kill this shrub. A 1% active ingredient (a.i.) 2,4,5-T, ester-diesel distillate combination (1 part 40% 2,4,5-T, ester to 40 parts diesel distillate) is particularly effective.

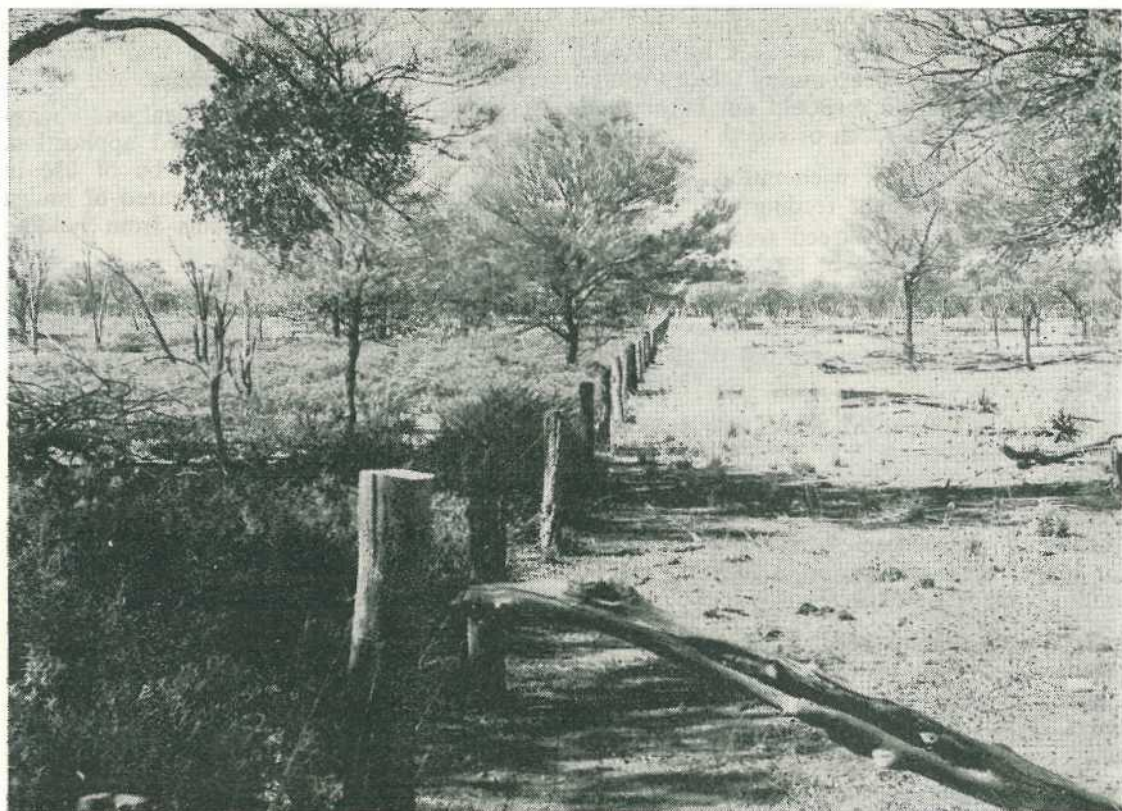
Biological control and grazing management techniques have also been investigated. Observant graziers would have noticed fence line contrasts similar to that in (plate 3). They appreciate from this that green turkey bush can be eradicated by sustained heavy stocking with sheep. While such a policy can control the shrub, it will achieve this only when all useful grasses and herbage have also been removed. It is questionable whether removal of the turkey bush by this method represents any real improvement of the country.

It is now known that reproductive processes (flowering, fruit set and germination) in green turkey bush are favoured by rains in the cooler months. It is also well known that the flowers are relished by sheep.

Strategic heavy stocking (up to 17 sheep per hectare) of dense stands of turkey bush for periods of 2 to 3 weeks following rain between March and October, when the plants are flowering, can prevent fruit set. This may limit seedling establishment. Most established mulga grasses are inactive during this period and will suffer little damage, especially if the country is rested during the following summer.

While such a stocking programme appears feasible, several difficulties are met in practical application. First, the procedure will have to be carried out over a number of years until individual bushes have died. (Green turkey bush is thought to have a lifespan of about 10 years). Secondly, it will require much





Turkey bush has been eliminated from the paddock on the right by stocking heavily with sheep (plate 3).

temporary fencing to confine flocks; and thirdly, the labour and cost of additional sheep husbandry will have to be considered.

Spectacular control of dense stands of green turkey bush has occurred through the action of a small wingless grasshopper (*Monistria pustulifera*). The shrub is a favoured host plant for the insect, but the grasshoppers rarely become sufficiently numerous to kill large infestations.

Nevertheless, a detailed study of the grasshopper's life cycle could determine reasons for this. For example, the sporadic nature of its distribution could be because most of the adults are wingless, and it may be possible to 'seed' turkey bush stands with fertilized eggs or nymphs. Officers of the Department of Primary Industries are currently examining some of these aspects.

### Cassia

Yellow flowered cassias are a familiar sight in semi-arid Australia, where they are often highly regarded for their value as browse plants and their aesthetic appeal. While usually not dense in undisturbed native vegetation, cassias are very responsive to disturbance. Well-known examples are firebush which is common along roadsides in the Charleville region and butterbush thickets in areas cleared of gidyea scrub.

Butterbush and silver cassia are normally found along creek frontages of the mulga-box associations in south-western Queensland, and frequently occur on areas used for water spreading. Water diversion onto these sites favours a rapid increase in the cassia popula-



tion. The improved moisture relations also tend to promote unpalatable agents in the plants and they become less acceptable as browse. In any case, they rapidly grow out of the reach of sheep.

Control of these plants has been attempted at 'Beechal', Cheepie, by ploughing, chemical sprays and heavy stocking with sheep. Ploughing butterbush and silver cassia was unsuccessful as the plants suckered profusely from the roots and germination of the seed appeared to be stimulated in the disturbed soil. The treatment cannot be recommended in the absence of a vigorous pasture species to compete with the root suckers and seedlings.

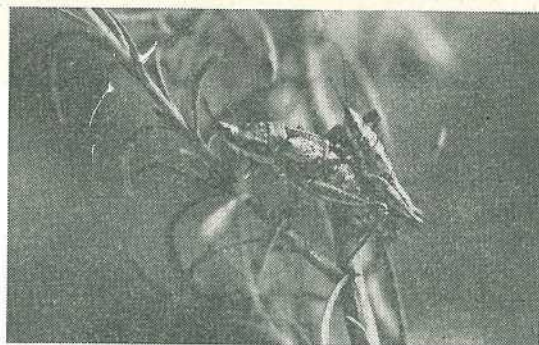
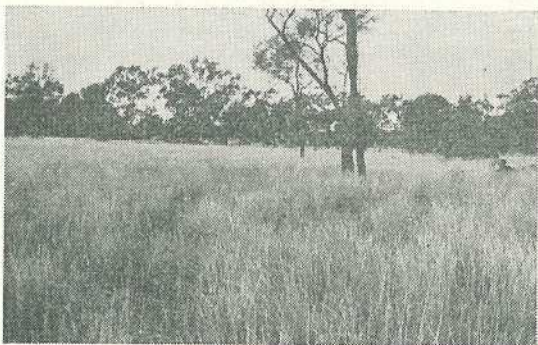
Overall spraying with picloram based chemicals (Tordon 50-D or Tordon 105) at 1 part of commercial product to either 25 or 50 parts of water resulted in more than 90% kill. The most effective treatment was a basal bark spray application of 1 part of Tordon 255 to 100 parts of diesel distillate. Both methods of treatment would be costly to apply on a large scale.

Although intensive stocking with sheep weakened the smallest plants, most bushes recovered and many appeared to have been stimulated by the browsing effect of the sheep. The stocking rate applied of 40 sheep per hectare for 2 weeks, followed by 5 sheep per hectare for the next 10 weeks was insufficient for this stand of 10 000 plants per hectare. Nevertheless, the method has some promise, provided no leaf of the plants is out of the reach of sheep. Sheep forced to graze these species of cassia showed no ill effects.

### Ellangowan Poison Bush

Ellangowan poison bush is a low growing plant widespread in south-western Queensland. Most properties contain only scattered plants although occasionally dense stands occur. Some forms of this plant are very poisonous when eaten by hungry sheep or cattle, particularly travelling stock. While seldom regarded as dangerous under normal grazing conditions, it should be eradicated from areas where mustered stock are held overnight, notably around stock route watering points.

Because of the nature of the plant and the fact that it seldom occupies large areas, control by chemical methods may be justified.



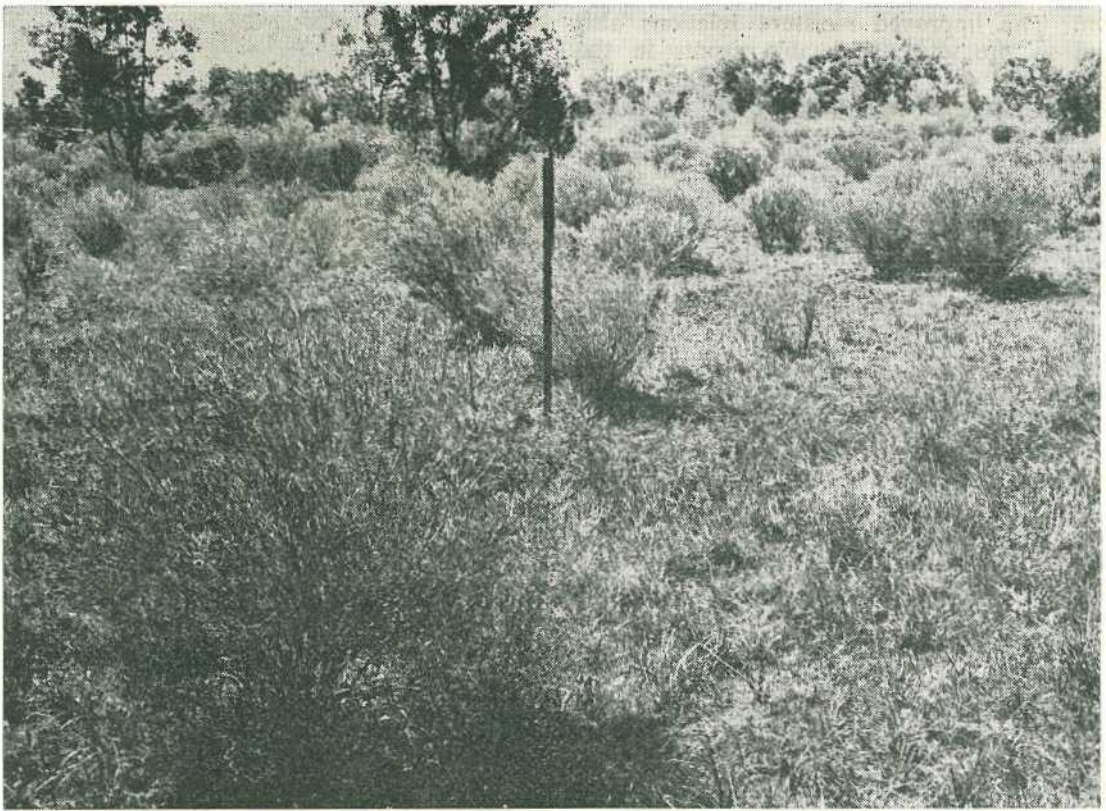
TOP. Land infested with turkey bush before an invasion by the turkey bush grasshopper (plate 4a).

CENTRE. The same site 12 months after a grasshopper attack (plate 4b).

BOTTOM. Male (upper) and female adults of the turkey bush grasshopper (plate 4c).

Trials in the Eulo area show that a 1% a.i. 2,4,5-T ester-diesel distillate combination (1 part 40% 2,4,5-T ester to 40 parts diesel distillate) applied as a high volume spray will kill the shrub. Care should be exercised to wet all the foliage. Few plants sucker if the trunk is cut off at ground level.





*Cassia on a water spreader at Cheepie (plate 5).*

### **General Discussion**

The most satisfactory management of woody plant communities is difficult to attain, and is a problem shared by landholders in other rangeland communities, particularly in southern Africa and the western United States. The question of correct utilization is no less difficult in Queensland's mulga lands.

For management to be successful, it must be based on sound ecological principles. It is essential for the grazier to appreciate that the soil-plant-animal relationship in this infertile semi-arid environment is extremely dynamic and very sensitive to manipulation, particularly stocking rates.

For domestic stock, the major nutritional deficiency on mulga lands is thought to be energy. Because grasses are the main source of energy, grazing pressure on these plants has been very high since settlement. Thus woody

plants, especially unpalatable weeds, have been favoured in the struggle for growing space.

Graziers now realize that this situation exists and have often tried to rest paddocks in an attempt to encourage grass response. Paradoxically, the competitive ability of the woody plants is so great that often the procedure has merely accelerated the increase in shrub density.

Are there any alternatives? Unfortunately, few. The use of fire as a management tool has been the subject of research in north-western New South Wales, but its practical application has still to be proven. In any case, as outlined earlier, fire followed by wind and water erosion of ash could result in the loss of important nutrients, especially phosphorus. As well, elimination of dead plant



material from the surface tends to reduce the number of sites favourable for pasture seedling establishment.

On economic grounds, the widespread use of chemical and mechanical control measures for unpalatable woody plants cannot be recommended. Where these techniques are applied on a limited scale, it is important to appreciate that mere killing of the plants without due consideration of what will take their place may prove to be a futile exercise. As a general guideline, woody plants are usually more favoured by cool season (March-September) rainfall than grasses. Where possible, management should therefore aim at resting treated country after summer rains, with more intensive use during the cooler months.

Grazing management and biological control techniques offer the best hope for improving utilization of mulga lands. Investigation of these alternatives is part of the continuing

programme of research at the Charleville Pastoral Laboratory, which is supported by the Australian Wool Corporation.

This programme aims at the best use commensurate with maintenance of the resource. Until answers are forthcoming, woody shrubs, both fodder plants and weeds, can be regarded as useful custodians of this delicately balanced ecosystem.

Botanical names of plants mentioned in this article are:—

Mulga .. ..	<i>Acacia aneura</i>
Wilga .. ..	<i>Geijera parviflora</i>
Berrigan .. ..	<i>Eremophila longifolia</i>
Green turkey bush ..	<i>Eremophila gilesii</i>
False sandalwood ..	<i>Eremophila mitchellii</i>
Firebush .. ..	<i>Cassia pleurocarpa</i>
Silver Cassia .. ..	<i>Cassia artemisioides</i>
Butterbush .. ..	<i>Cassia nemophila</i>
Ellangowan poison bush	<i>Myoporum deserti</i>
Wire grasses .. ..	<i>Aristida</i> spp.

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## Insects Threaten Grain Exports

EXPORTS of grain and oilseeds from Australia were being threatened by insect infestation, the Minister for Primary Industries (Hon. V. B. Sullivan, M.L.A.), said recently.

Mr. Sullivan said some major importing countries had complained about the presence of pests in grain shipments.

Commonwealth export grain regulations stated that shipments of wheat, oats, barley and sorghum must not contain live insects and indications were that all related commodities would be regulated in a similar way.

The Queensland Department of Primary Industries would conduct a State-wide campaign as part of a national programme aimed at greater control of grain pests, the Minister said. This action was supported by grain-handling authorities and the Queensland Grain Growers' Association.

It would seek the co-operation of grain, pig, poultry, dairy and beef producers, stock agents, produce merchants and other handlers of grain, manufacturers of farm machinery, and agencies which stored and/or transported grain.

To assist these people to identify and control the pests, the Department had published two booklets:—'Major Pests of Stored Grain' and 'Resistant Grain Insects—the On-Farm Problems.'

The first identified the main pests responsible for damage in stored grains and the second described hygiene practices for farm buildings, machinery and grain storage facilities.

'Queensland's stored grains are attacked by about 12 major pest species, although some 100 species are known to occur,' Mr. Sullivan added. 'All major pests have developed resistance to maldison, the protectant used when storing grains, and this resistance is widespread.'

# Timber Control in Central Qld.—2

by E. R. ANDERSON, Agrostologist; and G. R. BEESTON, Ecologist.

## CONTROL IN INLAND AREAS

### Brigalow Areas

Clearing brigalow for pasture development is now a well established practice. Usually buffel grass (*Cenchrus ciliaris*) is planted, either alone or in combination with green panic (*Panicum maximum* var. *trichoglume*) and/or Pioneer Rhodes grass (*Chloris gayana*).

Brigalow is a vigorous and persistent plant and sucker regrowth is the rule rather than the exception. Consequently, in brigalow development, follow-up treatment is usually essential to ensure the maintenance of a stable pasture. Regrowth can be treated by chemical methods or ploughing. In some circumstances fire can be used.

**CHEMICAL CONTROL.** The recommended chemical for aerial spraying is 2,4,5-T ester and for this chemical to be most effective there are **two** major considerations:—

1. The soil must be moist. Rain sufficient to achieve this is more likely to occur during summer and autumn than winter and spring.

2. The age and related growth habit of the regrowth are equally important. Kills of 85 to 95% have been obtained by spraying in the first growing season after pulling. This

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*Three-year-old brigalow suckers (in background) that have caused the pasture to be lost and are now too old to be killed easily with one spraying of 2,4,5-T (plate 8). ▼*





should be done as soon as all the suckers have emerged, 16 to 20 weeks after the initial burn.

Twelve weeks after the initial burn, 80% of the suckers will have emerged, and the population present will indicate whether spraying is necessary. If it is not possible to spray at the 16 to 20 weeks stage because the suckers are covered by grass, every effort should be made to ensure that they are sprayed in the following late spring after the first good fall of rain. By this time the grass should have been eaten down and the suckers exposed.

Older suckers (see plate 8) are more difficult to control with a single spraying as they have had time to build up root reserves. Besides, a complete coverage with the chemical is frustrated by the bushy regrowth. With a single spraying, kills of only 50 to 60% can be expected. However, if a second spray is applied 10 to 12 months after the first when conditions are suitable, then good kills are possible. See Table 3 for the results of double spraying on 4-year-old suckers, carried out at the Brigalow Research Station.

TABLE 3

DOUBLE V SINGLE SPRAYING ON 4-YEAR-OLD BRIGALOW SUCKERS. RESULTS FROM AN EXPERIMENT AT THE BRIGALOW RESEARCH STATION

Date of 1st Spraying: % Kill		Date of 2nd Spraying: % Kill		Time between Spraying (months)
January	41	December	88	
March	11	December	89	9
		February	89	11

Spraying requires a low capital outlay and there is no loss of income during treatment. If brigalow suckers are the only problem, spraying results in the virtual removal of the suckers, regeneration of pasture, increased production and a stable pasture system.

This is illustrated in Table 4 from the results of one of Mr. R. W. Johnson's experiments at the Brigalow Research Station. This shows an initial increase of a Rhodes grass pasture one year after spraying. With time, the pasture will recover fully and production will increase further, while the unsprayed pasture will deteriorate rapidly as a result of competition from the suckers.

TABLE 4

RESPONSE OF GRASS ONE YEAR AFTER SPRAYING BRIGALOW SUCKERS IN A RHODES GRASS PASTURE AT THE BRIGALOW RESEARCH STATION

Treatment	Weight of Dry Grass (kg/ha)	Weight of Suckers (kg/ha)
Sprayed .. ..	11 250	350
Not Sprayed .. ..	8 500	4 025

A further illustration of the effect of spraying on a sucker-infested pasture is given in Table 5. This was a mixed pasture of Rhodes grass, green panic and Biloela buffel grass that contained approximately 10 000 suckers per ha at the beginning of the experiment—an excellent pasture established initially with Rhodes grass as the dominant species. The suckers were sprayed at various ages.

The results show that a much higher population of grass plants results if the suckers are removed within the first 2 years. After 5 years, the grass plant population in the unsprayed area was reduced by half compared with the sprayed area. From now on, the suckers in the unsprayed area will cause a much greater reduction in the pasture.

The actual benefit from spraying should be assessed by its effect on maintaining grass productivity. If the original pasture has been lost the value of spraying is much reduced; consequently it is important not to let pastures degenerate to this state. If lack of finance restricts development and follow-up treatments cannot be immediately contemplated (that is, a second spraying of older suckers), the initial spraying will at least help to maintain the pasture for a few years until more permanent treatments can be applied. These may be further spraying, or burning and spraying. (See the later section under 'fire'.)

**PLOUGHING.** This is the most reliable method of controlling brigalow suckers. But it is costly because of the high capital outlay on equipment plus the fact that land is taken out of production for a while.

This cost can be readily recouped if cash cropping is practised or if fodder crops can be profitably utilized. However, not all areas are suitable for cropping for a variety of



*This area originally contained dense brigalow suckers. It has been ploughed to eradicate the suckers and planted to fodder crops (plate 9).*

TABLE 5

THE EFFECT OF SPRAYING BRIGALOW SUCKERS ON THE GRASS PLANT POPULATIONS AT 'CARDOWAN', SARINA. RESULTS RECORDED IN MAY 1971

Age of Suckers	Date of Spraying	Number of Grass Plants/ha			Number of Suckers/ha
		Buffel and Green Panic	Rhodes	Total	
10 months—December, 1966		10 300	23 800	34 100	Less than
23 months—January, 1968		10 900	27 300	38 200	
58 months—December, 1970		10 500	13 000	23 450	1 000
64 months—not sprayed		8 900	8 400	17 300	8 750

reasons. These include unsuitable soils, long distance from railhead, stage of development of the property, and shortage of finance. The unreliability of the climate adds a further risk to the venture and crop failures cannot be afforded when repayments for borrowed capital are required.

Ploughing needs to be at least 10 cm deep to be effective and generally at least three annual ploughings are required before appreciable sucker reduction occurs.

Better kills usually result from summer and early autumn ploughings than from those in winter and spring. This is illustrated in Table 6 where suckers were ploughed annually every February and September for 3 years with a 'Little Giant' offset disc plough.

However, control of suckers has been obtained much more quickly with double ploughing in the same growing season, with 16 weeks between each ploughing and when the soil was moist.



TABLE 6

EFFECT OF PLOUGHING ANNUALLY IN FEBRUARY AND SEPTEMBER ON THE CONTROL OF BRIGALOW REGROWTH IN AN EXPERIMENT AT THE BRIGALOW RESEARCH STATION

Time of ploughing	No. of Suckers/ha before ploughing	No. of Suckers/ha after ploughing			Estimated time to control these suckers
		1st ploughing	2nd ploughing	3rd ploughing	
February (summer) .. ..	20 750	17 750	10 750	5 250	About 5 years
September (spring) .. ..	17 500	19 250	20 500	14 250	Up to 10 years

Sucker reductions greater than 80% have been obtained from a single ploughing when a 'Majestic' plough was used. Good control has also been obtained after 3 years' annual cropping.

Regrowth following ploughing can readily be killed by spraying with 2,4,5-T as these suckers are at least as susceptible as those following the initial burn. Spraying should not be done until all the suckers have emerged (about 4 to 5 months after ploughing) and the soil is moist.

If an area is marginal for cropping, then ploughing is a high risk capital investment and spraying should first be seriously considered for brigalow sucker control. However, ploughing may still have a useful role to play in the re-planting of improved pasture species.

When ploughed land is planted to pasture, buffel grasses are the most suitable. The tall buffels (Biloela, Boorara, Nunbank, Molopo) are more productive and more tolerant of cold than the shorter buffels (Gayndah and American). Molopo buffel has the best cool season performance. On the less fertile and lighter textured soils, Gayndah and American have been preferred by some graziers. On the best soils, green panic can be planted.

**FIRE.** Fire is not generally recommended for controlling brigalow suckers. It will rarely reduce the number of suckers present and can, in fact, cause an increase in their numbers. Therefore, burning on a regular basis not only wastes feed but also can increase the hazard of sucker dominance in a pasture.

However, burning can be useful when followed by spraying. Older suckers sprayed 4 to 5 months after a burn can be significantly reduced by one spraying, whereas to obtain the same kill normally two sprayings 10 to

12 months apart would have to be used. If a paddock is burnt by a bush fire, such an incident can be capitalized on by spraying the regrowth.

Spraying of suckers after a grass fire should be deferred until most of them have emerged. If a good wet season has followed the burn then this should be 4 to 5 months after the fire. However, if the season has been dry, spraying should be delayed until the following late spring-early summer and done as soon as good soil moisture is present.

### Associated Species

**SHRUBBY SPECIES.** The most common species included in this broad category are false sandalwood (*Eremophila mitchellii*), currant bush (*Carissa ovata*), yellowwood (*Terminalia oblongata*), bean bush (*Cassia brewsterii*) and limebush (*Eremocitrus glauca*).

These occur as understorey species in the original brigalow scrub and, after pulling and burning, regenerate from butt suckers or (in limebush) root and stem suckers. Sandalwood will also sucker to some degree from the roots but not to the same extent as limebush or brigalow.

**FIRE.** The intensity of the initial fire has varying effects on these species. With sandalwood and currant bush, the best that can be expected is 30% to 60% reduction of the original population.

In yellowwood, a hot fire around the butt will kill a high proportion of the plants but this is often difficult to achieve; not only is yellowwood timber hard to burn but it is often difficult to get a fire to carry onto yellowwood areas. This occurs particularly when the yellowwood forms clumps which reduce the amount of grass that grows in their vicinity.



No reductions as a result of fire have been recorded for bean bush, and no data on the effect of the initial burn on limebush are available.

Thus, a hot burn is generally needed to achieve the best possible control of the above-mentioned species. Pre-requisites for this are a fair amount of timber and burning when the weather is hot and dry. The fire should be started on the off-wind side of the block and lighting continued all around the paddock. For best results, timber should be burnt in the year in which it is pulled and cattle should be excluded from the area between pulling and burning.

Pasture grasses should be sown as their successful establishment will allow the maximum return from the control measures. Buffel grass should be used in all sowings because of its strong persistence in Central Queensland. Green panic can be added in those parts of the region where soils are suitable.

Rhodes grass should also be included because of its ability to cover the ground early and fill the role of a pioneer competitor to weed regeneration. In many parts of the region, its persistence may be doubtful. However, by the time the Rhodes grass goes out, the buffel and/or green panic population should have built up sufficiently to fill the gaps.

If a hot initial fire can be obtained and a stable pasture established, the effect of the associated species in brigalow country can be greatly reduced. However, this has not occurred in many areas and woody weed regrowth is a problem (see plate 11). If brigalow suckers are present, these can be removed by overall spraying with a mixture of 2,4,5-T and distillate, but this spray will have little or no effect on the other woody weeds. Consequently they represent a real threat to pasture stability. The following methods can be considered for their control.

**MECHANICAL CONTROL—PLOWING.** Ploughing is the most effective and permanent method of control. It is, of course, limited to those areas that are suitable for ploughing, taking into account such factors as depth of soil and slope of land. Cost is also a major consideration. Ploughing is usually used when major reclamation is required. That is, when



*Sandalwood regrowth from stump 6 months after burning (plate 10).*

the regrowth has taken over to such an extent that the pasture has been lost or effective utilization can no longer be obtained from the paddock.

Good control can be achieved with a single ploughing, greater than 10 cm deep, on all the woody weeds except bean bush. On this species, ploughing has little effect. Following ploughing, if the land is not to be used for cropping it should be returned to pasture. Buffel grasses are the most suitable for sowing.

**ROOT RAKING.** In areas infested with sandalwood regrowth, root raking offers a relatively cheap method (compared with complete cultivation) for control. To be effective, it needs to be done when the soil is moist so that the sandalwood bushes are easily removed. The disturbed soil resulting from root raking will encourage the regeneration of the degraded pasture. If the pasture has been lost, buffel grass can be sown onto the rough seedbed.

Root raking is ineffective against bean bush, limebrush, yellowwood and currant bush. It is also ineffective in controlling brigalow suckers if they are present. However, this



species can be controlled by subsequent spraying with 2,4,5-T.

**CHEMICAL CONTROL.** To be worth while, chemical control should be carried out while some of the original pasture is still present. Availability of labour and cost of the treatment often restrict the use of this method to areas with light woody weed infestations. It can also be used on those areas not suitable for ploughing.

Each species requires a different treatment. For sandalwood, a basal bark spray with 2,4,5-T butyl ester in diesel distillate is used. This is effective on stems up to 10 cm thick and can be carried out at any time of the year. The base of each plant should be sprayed to a height of about 40 to 50 cm above ground level at a rate sufficient to wet the bark thoroughly without causing excessive run-off. Cutting the stems close to ground level and applying 2,4,5-T butyl ester in diesel oil is also effective at any time of the year.

For currant bush, an overall high volume spray with 'Tordon 50D' has proved most successful. Amitrol has also shown promise.

On yellowwood, the use of chemicals is doubtful. With an overall foliage application of 2,4-D or 2,4,5-T, rapid leaf fall occurs but most plants survive. Some success has been obtained by the cut-stump application of 2,4,5-T ester or mixed esters of 2,4-D and 2,4,5-T, in diesel distillate or water.

Reliable methods for the chemical control of bean bush have not been developed to date.

Limebush can be effectively controlled by overall high volume spraying with Tordon 50-D in water.

### Dawson Gum

Regrowth of Dawson gum (*Eucalyptus cambageana*) occurs from both lignotuber and seedlings following the initial burn. One cultivation with a 'Majestic' plough will give good control provided the lignotubers are all removed from the soil, otherwise a second ploughing is required.

Single stem saplings can be successfully controlled by stem injection with Tordon 105. In an experiment conducted by Mr. P. V. Back at the Brigalow Research Station (reported in the *Queensland Agricultural Journal*, November, 1972, pp. 579-86, 'Dawson Gum Control'), this was the most successful chemical. There was little difference between waist high and basal injection, 1% to 2% concentration, and time of application. Consequently injection can be carried out all through the year unless there is severe drought. (See Table 7).

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Dense regrowth of sandalwood after pulling and a light fire (plate 11). ▼



TABLE 7

## CONTROL OF DAWSON GUM SAPLINGS BY STEM INJECTION AT THE BRIGALOW RESEARCH STATION

Chemical or Product	Mixing Rate (in water)	Injection Height	Time of Application	
			Winter	Summer
Tordon 105 .. .. .	1 part in 4 parts ..	waist-high ..	90	% Kill 100
	1 in 4 .. ..	base .. ..	90	95
	2 in 3 .. ..	waist-high ..	95	100
	2 in 3 .. ..	base .. ..	90	100
Tordon 50D .. .. .	1 in 4 .. ..	base .. ..	65	95
	2 in 3 .. ..	base .. ..	75	90
2,4,5-T amine (20%) .. ..	1 in 1 .. ..	base .. ..	60	40

Mr. Back also treated multi-stem regrowth stump with Tordon 105 at 0.2% concentration (Table 8) and found it can be controlled by basal bark spraying with 'Tordon 255' at 0.5% concentration or by treating the cut respectively. When the soil is moist, these rates can be reduced to 0.2% and 0.1% respectively.

TABLE 8

## CONTROL OF MULTI-STEM DAWSON GUM REGROWTH BY BASAL BARK SPRAYING AND CUT STUMP METHODS AT THE BRIGALOW RESEARCH STATION

Product, Carrier and Mixing Rate	Method	Climatic Conditions			
		Dry		Wet	
		Autumn	Spring	Summer	Winter
Tordon 255 in diesel oil 1 part in 19 parts ..	Basal bark .. ..	% Kill			
		73	55	94	100
1 part in 49 parts ..		26	26	97	89
Tordon 105 in water 1 part in 24 parts ..	Cut stump .. ..	66	45	100	93
		34	23	91	88

Fire generally has a limited effect in reducing regrowth of Dawson gum, although results are variable and some good kills have been reported from a severe fire. On the other hand, fire is thought to stimulate germination of seed in the ground.

To limit seed production, standing Dawson gum trees should be removed during

pulling or killed by stem injection. It is better to remove the trees during pulling as the standing trees reduce the efficiency of aerial spraying of brigalow suckers. The extra pulling costs involved are offset by the subsequent advantages.

[TO BE CONTINUED]



# The Avocado

THE AVOCADO (*Persea gratissima* fam. Lauraceae) is a native of Central America and the West Indies. The trees are usually evergreen but some varieties drop many of their leaves and become almost bare during the blossoming period.

The habit of growth is variable. Some varieties are tall and upright while others are low and spreading. Under favourable conditions, the tree may reach a height exceeding 12 m with a spread of 7 to 10 m according to variety. Grafted trees which are recommended for planting tend to spread more than seedlings.

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by Officers of Horticulture Branch.

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The fruit varies in size and may be round, pyriform (pearlike) or oval. The external skin colour of the popular varieties ranges from yellowish-green through dark-green to purplish-black. The skin varies in thickness and may be smooth or rough in texture. The fruit contains a single large seed surrounded by flesh which is yellow to greenish in colour and has the consistency of butter when ripe.

## Production

During the statistical year 1972-73, Queensland had 38 000 bearing and non-bearing trees. Annual production was in the vicinity of 778 tonnes or 118 000 one-third bushel cartons valued at \$720 000.

The main producing centres are the Near North Coast from Caboolture to Gympie, Mount Tamborine, the Redlands district and the Brisbane Metropolitan area.



Harvesting fruit of the Hass variety.

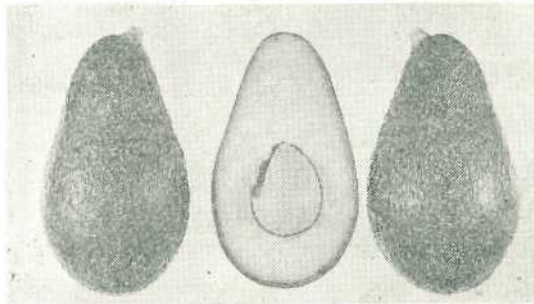
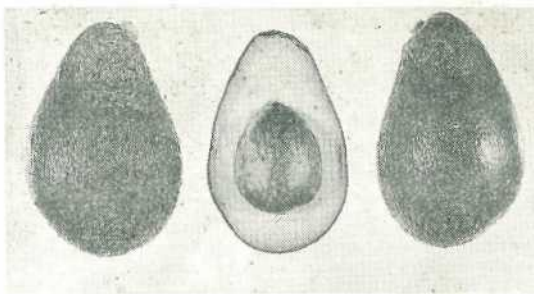
## Climate

The avocado will not tolerate extremes of temperature, although the Mexican race is somewhat resistant to frost and mature trees can survive temperatures of minus 6°C for short periods.

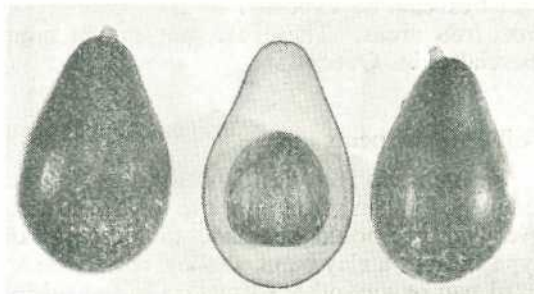
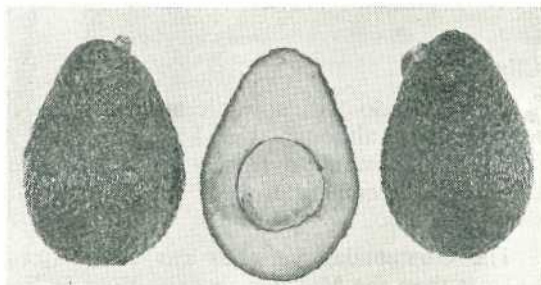
The Guatemalan varieties are less resistant to frost than the Mexican, but the West Indian varieties can be expected to do well only in frost-free areas. These are not grown commercially in Queensland.

## Soil Requirements

The avocado is extremely susceptible to poor drainage. When selecting a site for an orchard, every effort should be made to locate a soil type without a clay band, shallow rock outcrop, hard pan or any other formation in the subsoil which may impede the free flow of water through the soil.



TOP. The Fuerte variety.  
BOTTOM. The Sharwil variety.



TOP. The Hass variety.  
BOTTOM. The Rincon variety.

A minimum of 1.5 m of topsoil is required for the orchard and this may vary in texture from a sandy loam to a clay loam. Heavy clay loams are undesirable because of their natural association with poor drainage. An investigation of the soil profile to a depth of at least 2 m on a 20 m grid system is recommended for proposed avocado areas.

As with all other orchard crops, tree growth is most vigorous on soils that are well supplied with organic matter and possess an open structure. The most favourable soil reaction or level of soil acidity for growing avocados is a pH of 6.0 to 7.0.

### Varieties

The avocado varieties may be grouped into three horticultural races, namely Guatemalan, Mexican and West Indian. Commercial production in Queensland is restricted almost exclusively to the Guatemalan types and the Guatemalan-Mexican hybrids. The main characteristics of the above groups are as follows—

**GUATEMALAN.** Fruit normally ripens in winter and spring; rough, woody skin 1.5 to 3 mm thick.

**MEXICAN.** Small fruit maturing in midsummer to late autumn; smooth, thin skin up to 0.75 mm thick. When crushed leaves have strong aniseed aroma as do some Guatemalan-Mexican hybrids.

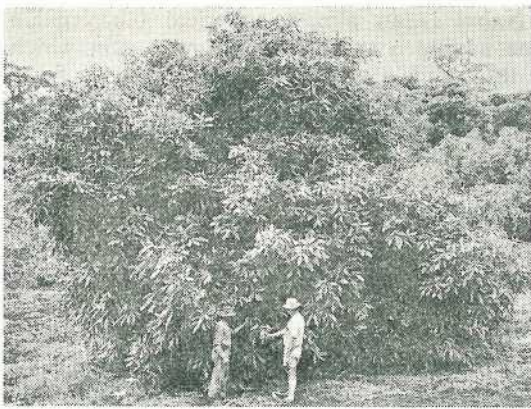
**WEST INDIAN.** This is similar to the Mexican; fruit ripens in summer to autumn; smooth, leathery skin slightly thicker than Mexican, up to 1.5 mm.

As with many tree crops, growing seedlings is not recommended as they are variable in fruit quality and production. Hence the industry in Queensland is based on grafted trees.

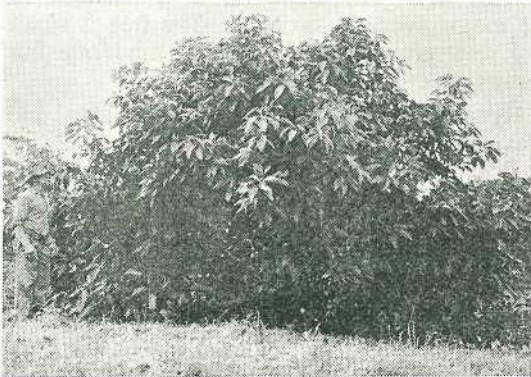
At present, the main commercial varieties in Queensland in order of importance are: Fuerte, Hass, Sharwil and Rincon. Hazzard, Edranol, Nabal, Wurtz, Ryan and Zutano are varieties of minor importance. Descriptions of some of the more important varieties are given:

**Fuerte** is the most popular variety in Queensland and makes up more than 40% of the total avocado acreage. It is a hybrid variety which exhibits characteristics of





TOP. An 8-year-old Hass tree.



BOTTOM. A Fuerte tree 4 to 5 years old.

both the Mexican and Guatemalan races. The pear-shaped fruit has a thin, leathery skin which is green and slightly pebbled. The flesh is a creamy-yellow and has a very rich flavour. The weight of the mature Fuerte avocado varies between 225 g and 425 g.

The variety which has an alternate cropping habit is harvested from April to September. Fuerte is particularly susceptible to anthracnose disease, and to injury from both fruit fly and fruit spotting bug.

**Hass** is a popular late Guatemalan type avocado and accounts for about 25% of Queensland's tree population.

The fruit is small to medium in size (170 g to 280 g), ovoid to pear-shaped, with a rough textured skin that changes from shiny green

to purplish black as the fruit ripens. Harvesting is from August to October in coastal districts and as late as January on the tablelands in some seasons. The tree is vigorous large and upright.

**Sharwil**, another popular variety in Queensland, produces fruit that has excellent flesh quality and weighs from 280 g to 400 g.

The fruit is ovoid to pear-shaped and has a green skin. Sharwil yields better in coastal districts than on the tablelands where it is often a shy and alternate cropper.

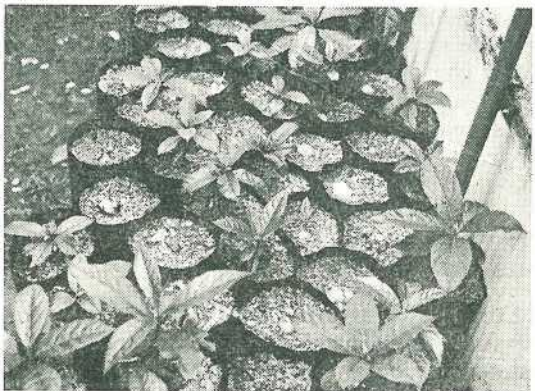
Harvesting begins in June and continues until late spring. The tree is strong growing and of medium height.

**Rincon** is a pear-shaped variety. The fruit which weighs from 225 g to 375 g has a dark green and fairly thin and smooth skin. Flesh quality is slightly inferior to that of Sharwil, Hass and Fuerte and the seed is larger.

Rincon has a fairly regular cropping habit and the tree grows only to 3 to 3.5 m high allowing closer planting and ease of harvest. Fruit is harvested from June to September.

**Hazzard** is a pear-shaped Guatemalan type, having a thin and rather rough skin which is green in colour.

The fruit has a delicious flavour and the flesh quality is excellent. When mature it weighs 280 g to 425 g. Hazzard grows slowly and attains a height of about 3.5 m to 6.0 m.



Avocado seedlings in plastic containers.





A hessian guard around a young tree for wind protection.

It is an early and regular cropper and, on the coast, the fruit is harvested in July and August. In some seasons, the skin is prone to cracking if the fruit is left on the tree too long.

**Edranol** is a pear-shaped Guatemalan type, producing fruit weighing 280 g to 425 g. The skin is green and slightly rough. Despite its excellent fruit quality, this variety has not been particularly popular among southern Queensland orchardists.

Edranol seems to be well suited to selected areas of the central coast. The tree has a distinctively erect shape and may exceed 6 m high. The fruit is harvested from May to August.

**Nabal** is an almost spherical Guatemalan type having a smooth, dark-green skin which is thin and of a corky texture. The fruit, which is of excellent quality, is large varying in weight from 425 g to 550 g, and is marketed from August to October. Nabal is losing its commercial popularity.

**Wurtz** is one of the more recent varieties introduced into Queensland and lateness of maturity is its most valuable commercial feature.

Harvesting extends from August to November. Fruit weighs from 225 to 300 g. Its medium size and large seed result in the flesh content of Wurtz being lower than that of the major avocado varieties. The tree is small and slow growing and produces moderate but consistent crops of fruit.

**Ryan** is a hybrid of the Guatemalan and Mexican types. The fruit weighing 225 g to 350 g is pear-shaped of fair quality and flavour. The skin is moderately rough and green. The tree has a large, well balanced growth habit and bears regularly but not as heavily as either Fuerte or Hass.

Ryan is classed as a late variety but the fruit is often palatable in July. The fruit will hold on the tree until the summer but quality deteriorates after early November.

**Zutano** is a pear-shaped Mexican type, having a very thin leathery light green skin. The fruit varies in weight from 275 to 325 g and is harvested in April and May. It is very susceptible to attacks from both fruit fly and fruit spotting bug.

### Propagation

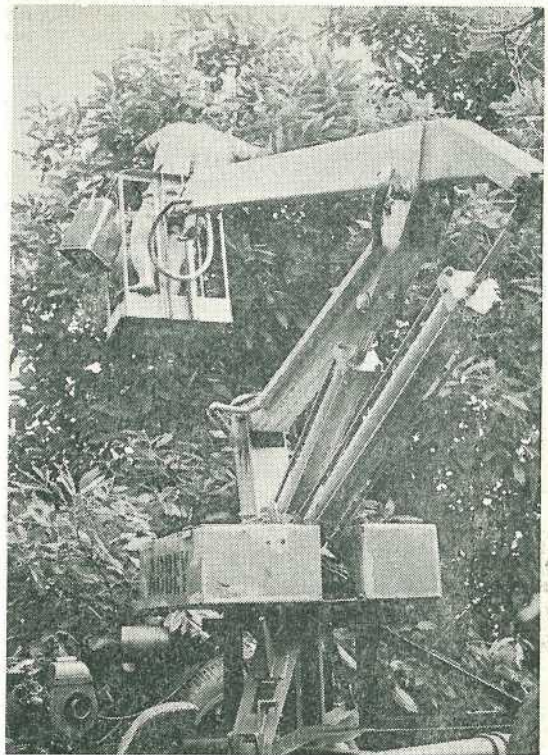
Vegetative propagation of the avocado is a standard practice in Queensland. Various methods are used by nurserymen and growers but generally the most reliable are the cleft graft, whip graft with and without the tongue, and on larger stocks the modified bark-graft and side graft. In all cases, fairly mature tip growth with two or three well-developed buds should be used.

Avocado propagation is now largely carried out in glasshouses, bush-houses or similar structures. Seed for rootstocks should be collected from fruit harvested direct from the tree to avoid infection by *Phytophthora cinnamomi*.





LEFT. A common method of harvesting avocados.



RIGHT. A hydraulically-controlled picking machine makes the job safer and less arduous.

Seed taken from fruit on the ground should be treated in hot water at 49° to 50°C for 30 minutes.

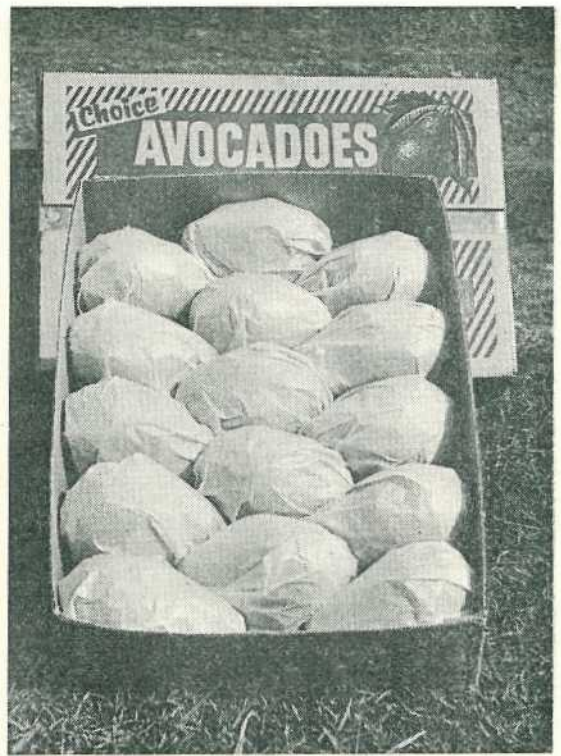
Grafted trees are raised in containers instead of nursery rows as was the practice previously. Seeds of the rootstock variety are planted with the apex just above soil level in specially-prepared sterile seedbeds or seedboxes which should be kept continually moist but not over-wet. Tank rain-water or decontaminated water instead of dam or bore water should be used to avoid introducing the root-rot fungus into the nursery soil or containers.

Coarse, clean sand which has been fumigated or uncontaminated sawdust is preferred as germinating media. When the primary shoots are about 4 to 6 cm high, the seedlings are transferred carefully into prepared containers of various types. Nine-litre plastic buckets are ideal, while tubes approximately 30 cm



Packing avocados.





Packed cartons of avocado fruit ready for market.

deep by 13 to 15 cm in diameter are also popular. The potting medium should be sterile, high in organic matter and have a pH of 6.0 to 7.0.

Where nursery row propagation is practised, rows are spaced about 90 cm apart with 40 to 45 cm between seedlings. Alternatively, seed may be planted in situ in prepared sites and grafted later.

Grafting is carried out when trees are 30 to 40 cm in height.

### Rootstocks

Over the years, many different rootstocks have been used in Queensland depending largely on seasonal availability. In California, preference has been given to Mexican strains, mainly because of their reputation for frost resistance, and this practice has been followed here to some extent.

Guatemalan and Guatemalan-Mexican hybrids are, however, used extensively as rootstocks and, in the main, produce vigorous trees. In recent years, there has been some interest in the Duke selections as rootstock material because of their alleged resistance to the root rot fungus, *Phytophthora cinnamomi*.

### Planting

Container-raised trees, given proper care and attention, may be planted at any time of the year. They are ready for transplanting as soon as the initial growth arising from the successful graft has hardened off. This usually takes 9 to 12 months from seed planting.

Before planting, the soil should be in the best condition possible if a uniform block of well-grown trees is to be obtained. Deep ripping is very desirable to improve the drainage of the subsoil. Incorporation of liberal



amounts of rotted organic material together with a light dressing of superphosphate worked into the top 30 cm of soil will give the trees an excellent start. The soil pH should be adjusted to between 6.0 and 7.0 by broadcasting an application of dolomite.

When planting the tree, the union should be kept above ground level, as far as possible, with the graft on the southern side to escape sunburning.

It is wise to protect the trunk and scaffold limbs from sunburn by painting them with white latex water-based paint. In some areas, hessian erected on stakes around the young tree will guard it against sunburning. The hessian will also provide wind protection.

Young trees can be protected from attack by hares or other animals by wrapping the trunk and branches with paper or alfoil or enclosing the tree with wire netting.

Immediately after planting, a basin should be formed round each tree and filled with water. Further irrigations at frequent intervals are required until the trees are firmly established.

### Tree Spacing

Tree spacing depends largely on the system of management. Most Queensland orchards have been established on a permanent spacing of 9 to 10.5 m using either the square or diagonal systems.

A recent trend is to use a modified hedge row system with spacings of 4.5 to 6 m along rows with rows 10.5 to 12 m part. When overcrowding occurs, in say 6 to 8 years from planting, alternate trees along the rows can be cut back hard or removed.

### Pruning

The avocado tree requires little or no pruning once the frame has been formed. In general, the aim is to establish a strong symmetrical tree having well-spaced branches that can support heavy crops of fruit.

At planting, if considered necessary, the young tree should be headed back just above the strongest of the dormant buds near the growing point. These buds usually make

upright growth. Subsequent pruning consists of pinching out terminal buds and the removal of crossing and unwanted branches.

The type and amount of pruning differs with varieties. Trees such as Fuerte, with a straggling and spreading habit, are pruned to force growth upwards. On the other hand, tall-growing varieties such as Edranol and Anaheim are cut to buds pointing outwards to preserve low heads. As the trees grow older, the lower limbs are shortened and finally removed to make room for the upper branches which bear down towards the ground.

### Soil Management

Two systems of soil management are in general use in Queensland orchards and are similar to those used in citrus areas.

These systems are—

- a. Clean cultivation with or without inter-row cover cropping.
- b. Sod culture where excess growth is controlled by regular mowing combined with weed control under the tree skirts.

In the first system, weeds are controlled by shallow cultivation to conserve soil moisture but deep working of the soil should be avoided at all times.

It is most desirable for the organic matter content of the soil to be built up to a high level, particularly under the trees, and maintained by regular dressings of chemically uncontaminated poultry litter or by green manure crops. Suitable summer species are maize, lablab bean, Sudan grass and Sudan grass-sorghum hybrids. In the winter New Zealand blue lupins, oats or barley may be grown.

In the permanent sod system, excess weed growth around and under trees can be controlled by using a desiccant herbicide such as paraquat. When spraying with this material, it should be kept off trunk, branches and foliage as damage will result.

With both systems of management, an endeavour should be made to establish and maintain a reasonably deep layer (8 to 15 cm) of organic mulch under the trees at all times to promote high microbiological activity.



Dead leaves or mulch should not accumulate close around the tree trunk. This will keep the trunk wet for long periods and favour infection by trunk rotting organisms.

### Nutrition

In Queensland, it is important to maintain adequate amounts of nitrogen, phosphorus, potassium, calcium, magnesium and zinc in the soil at all times.

The amount of fertilizer to apply in a particular situation will depend on the variety, the soil type and cropping history.

The following is a guide to a fertilizer schedule for trees of various ages.

**TREES UP TO 12 YEARS.** Apply 50 g nitrogen, 23 g phosphorus and 62 g potassium per tree for each year of age. This is equivalent to 400 g of a NPK mixture with a formula approximating 12:6:16.

**MATURE TREES.** Apply 620 g nitrogen, 290 g phosphorus, 780 g potassium per tree per year. This is equivalent to 5 kg of a NPK mixture with a formula approximating 12:6:16.

The annual fertilizer ration should be split into two applications. The first is applied before bud movement in winter to stimulate growth and flowering, and the second in mid to late summer for fruit filling and maintenance of tree vigour. Fertilizer should not be applied during the flowering period as flower drop and reduced fruit set may result.

The avocado tree will not tolerate excessive amounts of chloride and, for this reason, the potassium in the fertilizer mixture should be present in the sulphate form. Furthermore, it is undesirable to have all of the nitrogen present as sulphate of ammonia because of the acidifying effect on the soil.

Zinc deficiency occurs commonly in avocado orchards in south-east Queensland. The symptoms of zinc deficiency are interveinal yellowing and small leaves crowded close together on the terminal growth. The deficiency can be corrected with a zinc sulphate spray containing 100 g of 23% zinc sulphate (heptahydrate) in 100 litres of water. Sprays are normally applied in the spring.

In Queensland, the avocado appears to require a pH between 6.0 and 7.0 for satisfactory growth. Lime or dolomite should be applied when a soil test shows that it is necessary.

### Irrigation

There are certain periods in the development of the avocado crop when an adequate supply of water should be available to the trees. To achieve the best fruit set, soil moisture must be sufficient for the tree just before flowering, after fruit set and again during fruit filling in early summer.

The amount of water to apply at each irrigation and the frequency of irrigation will depend on the soil type, permeability, depth of rooting and age of tree. As a general guide, a mature tree should receive from 50 to 70 mm per application.

Excessive irrigation should be avoided as it can induce root rot.

### Harvesting

It is difficult to determine the correct stage of maturity at which to harvest avocados. Varieties that are dark-skinned when mature develop their full colour as they ripen, but the rest exhibit only a slight tinge of yellow as a background colour in the green skin and the fruit stalk.

Skill in determining maturity is necessary, the usual criteria being the known time of cropping for the variety, fruit size and a dulling of the surface gloss on the skin. In Queensland an oil content of 15% is prescribed within the period 1 January to 30 April as a minimum standard for fruit maturity in the varieties Fuerte, Edranol, Zutano and Rincon, and at least 10% in all other varieties.

The times of harvesting of the more important varieties are:—

Variety	Coastal Areas	Tablelands
Fuerte .. ..	April-July	June-Sept.
Edranol .. ..	May-July	June-Aug.
Rincon .. ..	June-Aug.	Aug.-Sept.
Sharwil .. ..	June-Sept.	Sept.-Oct.
Hazzard .. ..	July-Aug.	Aug.-Sept.
Nabal .. ..	Aug.-Sept.	Sept.-C <sup>t</sup> .
Hass .. ..	Aug.-Oct.	Oct.-Dec.
Wurtz .. ..	Aug.-Sept.	Oct.-Nov.



Avocados should never be pulled from the tree, as damage at the stem end makes the entry of decay organisms more likely. The fruit should be double-cut with round-nosed clippers, leaving a very short stub on the stalk end. As the skin is easily bruised, avocados require careful handling.

The age at which avocado trees come into bearing depends on the variety. A commercial crop from some varieties may be expected by the third or fourth year. Annual returns are difficult to assess because of the pronounced tendency towards alternate bearing. A mature tree may bear up to 40 cartons of fruit in a good season.

### Marketing

Avocados are packed in cartons containing a single layer of fruit which is usually wrapped to reduce damage in transit. The container measures 450 mm long x 290 mm wide x 90 mm deep.

The word 'avocado' or the abbreviation 'AVO' and the name of the variety or in the case of an unnamed variety, the word 'seedling' should appear on the container. In addition, the size or count of the fruit contained in the carton should also be shown.

## DISEASES AND PESTS

### Diseases

The major avocado diseases in Queensland are root rot, *Verticillium* wilt and fruit rots.

**ROOT ROT.** Successful avocado growing in Queensland is restricted to areas that are well drained. In poorly drained soils, the trees almost invariably succumb to root-rot caused by the soil fungus *Phytophthora cinnamomi*.

Symptoms shown by infected trees are yellowing and wilting of the leaves, followed by leaf fall and dieback on the young shoots. In the later stages of infection, the entire tree is reduced to a leafless skeleton and dies out completely. The fungus that causes the disease lives in the soil and multiplies rapidly under wet conditions. The fungus is common in Queensland soils, also attacking pineapples, and many native tree species.

Control measures that may be taken against the disease are—

1. Plant avocados only in deep, well drained soils.
2. Plant only healthy trees.
3. Construct surface drains to minimize water-logging during wet weather.

**VERTICILLIUM WILT.** This disease is also caused by a soil fungus *Verticillium dahliae* which enters the roots of the tree and invades the water-conducting system.

The leaves, after wilting, turn brown and remain attached to the tree. If the bark of the infected branch is peeled away the underlying wood is usually streaked black or dark brown. Dead branches should only be removed after dieback has finished and new growth has commenced.

**FRUIT ROTS.** Fruit rots affecting maturing avocados are mainly *Dothiorella* which causes a surface rot and stem-end rotting, and *Anthraco* which causes a surface rot. These fungi live on dead leaves, prunings, and dying twigs. Their spores are splashed by rain onto fruit, and the fungus may become established long before fruit maturity is reached. The infections later develop into serious fruit rots as the avocados ripen during transport.

The incidence of fruit infection is highest in wet weather, which favours the production of fungal spores and their dispersal.

Control measures for fruit rots include careful orchard hygiene and pruning dead wood from the trees. Careful handling of fruit during harvest is essential. The fruit should be kept cool after harvesting and packing in well ventilated containers will help to minimize losses. In very wet years protective fungicides may have to be used to control ripe fruit rots.

### Pests

The main pests of commercial importance in avocados are fruit fly, fruit-spotting bug, latania scale and red-shouldered leaf beetle.

**FRUIT FLY.** The fruit fly is one of the most troublesome of the insects attacking avocados. Damage is more severe usually in early maturing varieties, such as Zutano and Fuerte, than in late maturing types such as



Hass, Ryan and Nabal. The fruit fly sting develops into a star-shaped crack with raised edges, from which sap exudes and dries as a white residue.

Control measures for fruit fly consist of applying 0.2% DDT sprays during the period of this pest's greatest activity, usually mid January to mid February. Two to three spray applications at 2-week intervals are recommended.

**FRUIT-SPOTTING BUG.** This pest produces a plateau-shaped lesion on the skin, often with narrow cracks and deep internal damage. New damage exhibits a water-soaked area from which the sap exudes and later on dries to a white residue as in the case of fruit fly stings. It is often difficult to differentiate between damage caused by fruit spotting bug and fruit fly.

Fruit-spotting bug activity is usually fairly localized in the orchard and often occurs on groups of fruit on tall trees in the end rows. In areas where the bug is known to occur, trees should be inspected regularly for fresh

damage. DDT (0.1%) or trichlorphon (0.1%) sprays give effective control of this insect.

**LATANIA SCALE.** A build up in latania scale may follow the use of DDT sprays. A 1 in 60 white oil application in April is the recommended control measure if scales are present. Timing is important and the spray should be applied when the maximum number of young crawlers have emerged.

**RED-SHOULDERED LEAF BEETLE.** Plague numbers of red-shouldered leaf beetle can occur on avocado trees in spring and summer. Blossoms and foliage may be destroyed and exposed twigs become sunburnt and die back. Foliage, growing points and fruit can also be damaged by sudden plagues in summer. Sprays of 0.1% DDT or 0.1% trichlorphon give good kills but repeat applications may be needed to control re-infestation.

Detailed information on diseases and pests of avocados is available from the Department of Primary Industries.

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## Feeding bacteria to prevent disease

THE possibility of feeding chickens with micro-organisms from older birds to help control disease was reported in the course on Recent Advances in Animal Nutrition held at the University of New England, Armidale.

This course was the first of a series of refresher courses planned by the University's Faculty of Rural Science and Department of Continuing Education. It attracted nutritionists in the stock feed industry and Departments of Agriculture from throughout Australia and New Zealand.

Professor G. L. McClymont, Dean of the Faculty of Rural Science, said that two Faculty members, Associate Professor Cumming

and Dr. Lloyd, were working with their post-graduate students on coccidiosis and Salmonella infections.

These two poultry problems have not been satisfactorily controlled by hygiene or drugs. The work indicates that the severity of these diseases can be reduced by feeding young chickens with gut contents from adult birds.

Micro-organisms from the adult birds were apparently occupying ecological niches in the gut of the young birds, preventing the disease organisms from establishing themselves. Although much more work had to be done, the findings gave encouragement that the approach was valid.

—University of New England news release.



# Loss from Skin Damage in Pigs

by D. HILL, Slaughtering and Meat Inspection Branch.

OF the three main food animals slaughtered for human food, the pig is the only one from which the skin is not removed.

The skin of the pig is left on the carcass and is eaten as the crackling of joints of pork.

It is therefore necessary, when pig carcasses are being inspected, to have all skin blemishes, including mange, eczema or marked skin discoloration cut out.

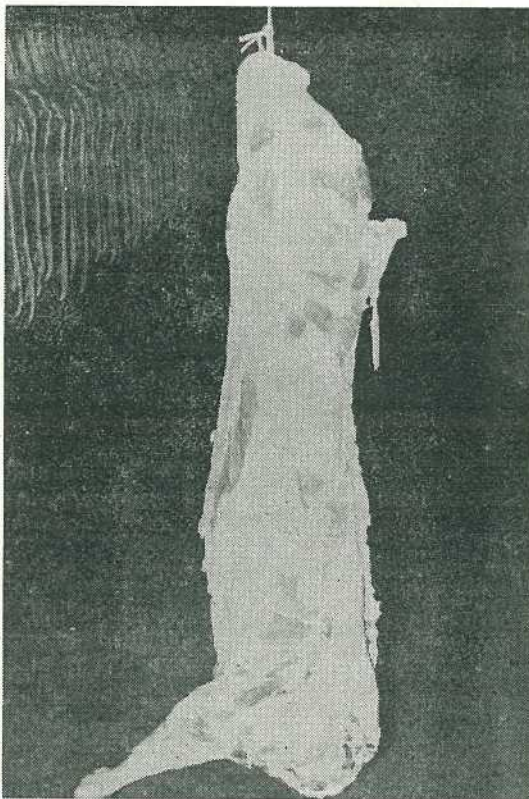
This, of course, gives the carcass an unsightly appearance and makes it unsuitable for display in retail shops. Ham and bacon manufacture is also made more expensive as badly spoiled carcasses are suitable only for canning, pressed ham, or smallgoods manufacture.

The most common skin conditions seen in pigs at slaughter include mange (demodectic and sarcoptic), epidermoid cysts, transit erythema, urticaria and swine pox.

## Two Common Diseases

Demodectic mange and epidermoid cysts are two conditions that should be mentioned together, as it is almost impossible to distinguish between the two conditions during routine inspection.

They are perhaps the most common cause of skin damage seen in pigs at slaughter and are found mainly in older pigs, such as culled breeding stock.



A skinned pig carcass.

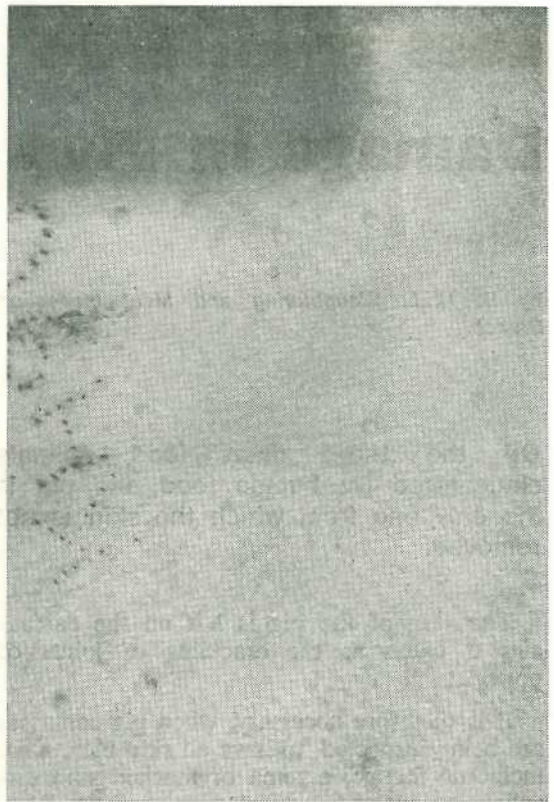
Epidermoid cysts are considered to be caused by blockage of the skin ducts. This causes a cyst to form, which appears very similar macroscopically to the condition caused by demodectic mange.

Without microscopic examination the two conditions can be confused. However, both conditions warrant condemnation of the affected parts.

Demodectic mange is caused by a parasitic mite (*Demodex phylloides*) which gains entry to the hair follicles and sebaceous glands. This sets up a chronic inflammation and usually a secondary infection occurs forming pustules and abscesses.

These pustules can vary in size and light infestations can be hard to detect.





Two examples of the skin blemishes caused by demodectic mange or epidermoid cysts.

Lesions usually appear first on the snout, around the eyelids, then usually spread to parts of the body where the skin is soft and thin, such as the throat, breast and abdomen. However, infestation may occur on any part of the skin.

The condition is difficult to recognize on the live animal.

From December 1971 to November 1972 inclusive, a survey was carried out on the incidence of demodectic mange in pigs supplied to a large meatworks.

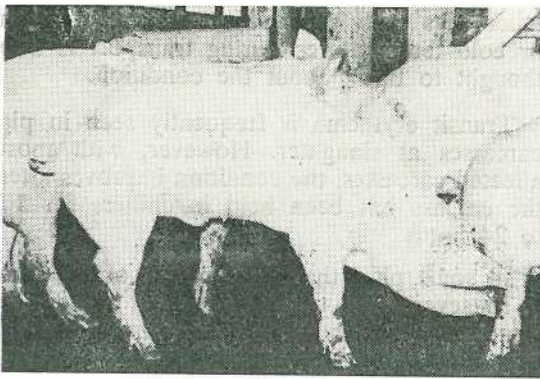
Some of these skin lesions were examined microscopically. In some, the parasitic mite (*Demodex phylloides*) could be identified. In others, no mites were found.

The figures showed that in the 12 months surveyed, 103 880 pigs were submitted for slaughter, drawn from a wide area of the Darling Downs.

Pigs infested with demodectic mange and/or epidermoid cysts were received from 120 different piggeries, widely scattered throughout the supply area. Of these, at least four suppliers were dealers who buy pigs at saleyards. This suggests that even more piggeries may be involved.

The 120 piggeries supplied 34 572 pigs, of which 211 pigs were infested. Of these, 148 had to be totally skinned for a weight loss of 2 243 kg, 63 had to be partially skinned for a weight loss of 264 kg, a total weight loss of 2 507 kg.





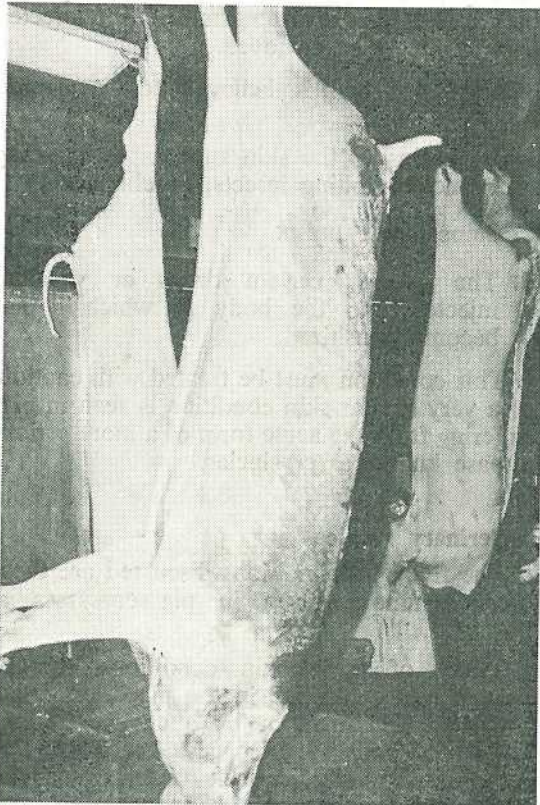
Swine pox.

On a percentage basis, 211 represents only 0.203% of the total kill during the survey period or only 0.61% of the pigs supplied by the 120 infested piggeries. However, on an individual property basis, the percentage varies from as low as 0.075% infestation to as high as 22.2%.

As this skin condition can be difficult to treat and eradicate from a piggery, veterinary advice should be sought.

### Sarcoptic Mange

Sarcoptic mange is a skin condition caused by a parasitic mite (*Sarcoptes scabiei*) that burrows into the skin and also feeds off the skin.



▲ Transit erythema.



▲ Urticaria, nettle rash or diamond disease.



The irritation from this causes itching and scratching, and the skin becomes inflamed, thickened and wrinkled. The damage to the skin spoils the appearance of the dressed carcass and its value may be greatly reduced if it becomes necessary to remove the skin.

This condition also causes economic loss in the young, growing pigs. Because of the severe and constant irritation, young pigs do not make normal growth and remain unthrifty and stunted. In older pigs, fattening is delayed as the pigs fail to make normal weight gains for food intake.

Modern insecticides have made this disease much easier to control. However, in spite of this, the disease is still frequently seen in pigs at slaughter and the affected skin has to be removed.

### Swine Pox

Swine pox in its active stage is seen only occasionally at abattoirs. However, it is common to see skin blemishes on pig carcasses as depressions or craters left on the skin after the pox pustules have dried up.

It is seldom necessary, however, to have these old skin wounds removed. However, they do affect the appearance of the carcass and may reduce its value to certain sections of the industry.

The disease is caused by a virus and can be spread through a piggery by the pig louse. Mosquitoes are also thought to be responsible for its spread.

The disease is easily recognized and pigs showing any evidence of the disease should not be sent to slaughter until they have completely recovered and all signs of active lesions have disappeared.

### Transit Erythema

Transit erythema is a skin condition usually seen in pigs that have had to travel long distances by rail or road to the abattoirs.

The condition is seen as red patches on the skin along the belly, hams and commonly along the backline.

It is believed to be caused by irritation of the skin from disinfectants and urine on the floors of trucks and direct contamination from

other pigs with urine. Exposure to the sun or cold temperatures during transport is also thought to bring about the condition.

Transit erythema is frequently seen in pig carcasses at slaughter. However, with most affected carcasses, the condition improves after the carcass has been held in chillers for 12 to 24 hours.

In some pigs, the inflammation of the skin is so severe that the affected part has to be removed, thus impairing the appearance of the carcass and reducing its value.

### Diamond Disease

Urticaria, nettlerash and diamond disease are all terms used to describe a skin condition of pigs characterized by the appearance of small inflamed areas or weals on the skin. These areas may be circular, but are usually rectangular or diamond shaped. They may appear on any part of the body, but are usually seen on the sides, backline and hams. The affected parts have to be removed.

This condition is believed to be caused by—

1. Irritations to the skin such as being stung by nettles, biting insects, or chemicals.
2. Some dietary upset.
3. The use of certain drugs or vaccines injected into the body to which it has become sensitized.

This condition must be treated with caution, as a very similar skin condition is seen in pigs suffering from the acute form of a more serious disease known as erysipelas.

### Veterinary Advice

The five skin conditions discussed are those most commonly seen in pig carcasses at slaughter.

Many of these skin conditions can be treated and controlled in the piggeries, either by direct treatment or by a change in husbandry methods. It is suggested therefore that a pig farmer should seek veterinary advice if he is losing money through skin diseases in his pigs.



# Soybean Trials in Brisbane Valley

Authors: G. F. FILET and A. J. P. WILLIAMSON, Agriculture Branch.

SOYBEAN is not a new crop in the Brisbane Valley. What is noteworthy is the tremendous expansion that has taken place in soybean growing in this district in the last 5 years.

Soybeans have been grown in the Brisbane Valley for many years. Some dairy farmers sporadically planted the crop. When weather conditions were favourable, the crop was grown for grain which was used as a valuable feed supplement to the dairy herd in winter. When dry weather prevented grain production, the soybeans were grazed off or made into hay.

The area planted has increased markedly since 1968 when 36 ha of commercial soybeans were grown. The area quickly expanded in the following years to 80, 200, 800 and 1 600 ha in the 1972-73 season.



A soybean trial plot on Mr. N. O. Bischoff's property at Buaraba Creek being hand-harvested. The harvest is taken from the two centre rows of each four-row plot, with a section at each end of the plot left unharvested. The plants are cut with knives and taken to a mobile threshing machine.





*A group of Brisbane Valley farmers examine the soybean trial plots on Mr. Bischoff's property.*

There were several reasons for the spectacular increase in soybean plantings. The main ones were:

1. Oil and stock feed processors, who previously had been operating on the Darling Downs, turned their attention to the West Moreton region. Gillespie Bros. Pty. Ltd. and Meggitt Ltd. were the first to offer contracts. The soybean area in the Brisbane Valley district significantly increased in the 1971-72 season when Provincial Traders Pty. Ltd. assisted by the Queensland Grain Growers' Association started operations.
2. Fluctuating market returns for potatoes and onions had caused concern to cash-crop farmers, who were mainly centred in the Lowood area. There was a developing trend to diversify into 'contract crops' which gave a more stable income. Crops under consideration were beetroot for canning, and peas and beans for the snap-frozen industry. The offer to grow soybeans under contract was quickly accepted by growers.
3. Farmers had had difficulty in implementing a sound rotational cropping programme. This led to a gradual decline in soil structure. The absence of a legume crop that could provide a cash return to counter increasing costs and land values was sadly felt. The demand for soybeans proved a valuable solution. Soybeans are a desirable crop for the Brisbane Valley. As a legume crop they form a valuable component of any crop rotation. When properly nodulated the plants do not draw heavily on soil nitrogen. They obtain the major part of their nitrogen requirement from atmospheric nitrogen, fixed by the bacteria in the root nodules.

It is, however, not just a nitrogen-fixing crop, for the grain is much sought after by oil seed processors at very attractive prices. The grain provides an excellent high-protein meal for stock feeds as well as oil.





*A mobile threshing machine is used to thresh the harvests from the soybean trial plots. The Department of Primary Industries has several of these machines. They are towed easily by a utility and thresh harvests from trial plots quickly and efficiently.*

The crop also has the reputation of improving the soil structure and easing the preparation of the seedbed for the following crop. In the Brisbane Valley such following crops are spring potatoes, peas, winter grains (barley or wheat) and winter fodder crops (oats or barley).

Before soybean testing began in the Brisbane Valley, it was estimated that, for the crop to be economically feasible, yields would have to exceed 1 000 kg per ha in rain-grown plantings and 1 880 kg per ha under irrigation. It was also considered that the combined oil and protein content of the grain should exceed 56%.

By 1969, the Department of Primary Industries soybean testing programme on the Darling Downs had shown that some varieties were capable of producing good economic yields in that region. It was decided in 1969 to extend the testing of these varieties to the Brisbane Valley. The first of a series of trials

was laid down at Buaraba Creek in December 1969. By the end of the 1972-73 season, six trials had been completed. These are described.

### **Climate**

The area in which the trials were conducted lies in the 750 to 1 000 mm rainfall belt with 65% of the total falling from November to April. Actual rainfall on the experimental areas is given in Table 1.

Mean maximum summer temperatures are between 26.5°C and 32.5°C and the mean minimum temperatures are between 15.5°C and 18.5°C.

### **Trial Sites**

Two trials were conducted at Buaraba Creek on the property owned by Mr. V. Hansen and later Mr. N. Bischoff. The soil was a brown clay loam with a low nitrogen content. Available potassium was good but available phosphorus was low. This deficiency was made good with applications of 250 kg per ha superphosphate before planting.

The third and fifth trials were conducted at Lowood on the property of Messrs. H. C. and M. A. Stevens where the soil was a deep alluvial grey clay with high nitrogen, potassium and phosphorus content.

The fourth and sixth trials were conducted near Toogoolawah on the property of Messrs. L. N. and N. Bourguignon. Here, the soil was a deep brown, alluvial clay with fair nitrogen and high potassium and phosphorus content.

The land at all sites was carefully prepared before planting to seedbeds of medium-fine tilth.

### **Planting**

The trials were all planted in December of the respective seasons into soil which was moist to a depth of at least 60 cm.

Planting was done by hand in the trials at Buaraba Creek and by precision planter at Lowood and Toogoolawah. Planting depth was 4 to 5 cm and the planting rate was 26 seeds per metre of row.



All plots contained four rows and the inter-row spacing was 70 cm. The trials were planted as randomized blocks and were repeated three times.

Seed was inoculated with commercial peat form inoculum, strain CB1809.

### Progress

Nodulation was very good in all varieties used in all trials.

Weed growth was controlled by inter-row cultivations while the plants were small. Some grass weeds and bell vine were present in the later stages of all trials, when inter-row cultivations were not possible because the plants were too big.

The trial at Buaraba Creek in 1969-70 received 3.8 cm of irrigation in mid February and the trial at Lowood in 1972-73 received 7.5 cm of irrigation in early February. No other irrigation water was applied at any site.

Plant stands in the variety Bragg were not good in the 1972-73 season trials and yields were depressed.

Green vegetable bugs appeared, after flowering, in all trials except the 1969-70 trial at Buaraba Creek. These insects were controlled by spraying with DDT or endosulphan and little or no crop damage occurred.

### Harvesting

The two centre rows of each plot only were harvested to determine yield, after the plot ends had been trimmed to eliminate end effects.

Harvesting of the two trials at Buaraba Creek and the trial at Toogoolawah in the 1971-72 season was done by hand and the harvests threshed in a stationary thresher. The other trials were harvested by auto-header.

### Results and Conclusions

The grain yields from individual plots in all trials were analysed statistically and necessary differences computed at the 5% level of probability. These differences show the amount by which the yield of one variety must exceed the yield of another variety to be actually higher yielding.

Details of yields from the trials are given in Table 2. The numbers V, VI, VII, VIII, and IX given after the variety names in the table refer to the maturity group rating of the variety. In the Brisbane Valley, group V are very early maturing, group VI early maturing, group VII medium maturing, group VIII late maturing and group IX very late maturing.

Details of oil and protein content of the grain for the 1969-70 to 1971-72 seasons are given in Table 3.

In 1969, recommendations based on performance in other areas were made for growing the varieties Hill, Leslie, Wills and Semstar in the Brisbane Valley. As a result of this series of trials and others in Queensland, the varieties Davis, Bragg and Hampton are now also recommended for the Brisbane Valley.

The variety Semstar is very susceptible to the leaf diseases bacterial pustule and wildfire. Hampton is of similar maturity to Semstar but is resistant to these leaf diseases. Hampton also has a better combined oil and protein content and could advantageously replace the Semstar variety.

The variety Hill is recommended for planting when a very early maturing variety is needed to assist with rotational requirements, but very early maturing varieties should **not** be chosen in preference to later maturing varieties in normal situations.

The Brisbane Valley has proved an excellent area for soybean production and yields can be expected to exceed the minimum levels for economic production in both rain-grown and irrigated crops. The recommended varieties will provide grain of adequate oil and protein content.

### Acknowledgement

The valuable assistance of the following co-operators is gratefully acknowledged: Mr. V. Hansen, Ipswich (formerly Buaraba Creek); Mr. N. O. Bischoff, Buaraba Creek; Messrs. H. C. and M. A. Stevens, Clarendon, Lowood; Messrs. L. and N. L. Bourguignon, Toogoolawah.



TABLE 1  
MONTHLY RAINFALL AT TRIAL SITES (MM)

Month	Trial 1 Buaraba Creek 1969-70	Trial 2 Buaraba Creek 1970-71	Trial 3 Lowood 1971-72	Trial 4 Toogoolawah 1971-72	Trial 5 Lowood 1972-73	Trial 6 Toogoolawah 1972-73
November .. ..	55.6	93.5	106.9	66.3	186.4	130.6
December .. ..	77.5	267.2	124.7	194.5	85.9	111.8
January .. ..	158.2	155.4	128.8	98.0	95.5	122.2
February .. ..	55.6	262.6	190.8	163.0	144.4	202.7
March .. ..	106.9	31.0	103.6	74.8	40.4	37.8
April .. ..	10.7	13.2	112.0	136.0	7.7	11.9
Total .. ..	464.5	822.9	766.8	732.6	560.3	617.0

TABLE 2  
GRAIN YIELDS (KG/HA)

Variety	Maturity Group Rating	Trial 1 Buaraba Creek 1969-70	Trial 2 Buaraba Creek 1970-71	Trial 3 Lowood 1971-72	Trial 4 Too- goolawah 1971-72	Trial 5 Lowood 1972-73	Trial 6 Too- goolawah 1972-73	Means
1 Davis .. ..	VI	3982.20	3377.57	4047.94	3612.01	3082.91	3574.74	3612.88
2 70/50 .. ..	VII	..	..	..	..	3515.36	3325.54	3420.45
3 Wills .. ..	VIII	3398.43	3021.05	3163.62	3686.74	3138.71	2926.97	3222.59
4 Leslie .. ..	VIII	3460.97	2795.88	3313.08	3362.90	2929.46	3288.17	3191.74
5 Bragg .. ..	VII	..	3460.28	3375.36	3537.28	2664.42	2639.36	3171.34
6 Hood .. ..	VI	..	..	3512.37	4128.90	2650.47	2241.94	3133.42
7 Dare .. ..	V	3043.99	3152.41	3039.07	3232.12	..	..	3116.90
8 Gilbert .. ..	IX	..	..	2715.23	3512.37	..	..	3113.80
9 Hampton .. ..	VIII	..	..	3587.10	3213.44	2845.76	2640.50	3071.70
10 Semmes .. ..	VII	..	3039.81	2939.43	3200.99	2776.02	2964.34	2984.12
11 Pickett .. ..	VI	..	2852.17	2827.33	3076.43	2748.12	2976.79	2896.17
12 Hill .. ..	V	2752.10	2476.89	3375.36	3306.86	2776.02	2652.96	2890.03
13 Semstar .. ..	VIII	3127.39	2533.18	3138.71	2964.34	2510.97	2926.97	2866.93
14 HRS 68/3 .. ..	VIII	..	2777.12	..	..	..	..	2777.12
15 Daintree .. ..	IX	..	..	2515.95	2939.43	..	..	2727.69
16 Telstar .. ..	VIII	2710.40	..	..	..	..	..	2710.40
17 Bellaire .. ..	VIII	2814.65	2270.49	..	..	..	..	2542.57
18 H.R.-1 .. ..	V	..	..	..	..	2385.42	2607.97	2496.70
19 Ross .. ..	IX	..	..	2827.33	1967.92	..	..	2397.63
20 Hinn .. ..	V	..	2232.96	2515.95	2360.26	..	..	2369.72
21 Rhosa .. ..	V	..	..	..	..	2078.52	2491.04	2284.78
22 K.162 .. ..	IX	2272.57	..	..	..	..	..	2272.57
23 H.R.-2 .. ..	V	..	..	..	..	2273.82	2092.47	2183.15
24 K 44 .. ..	IX	2084.92	..	..	..	..	..	2084.92
25 K 69 .. ..	IX	2043.23	..	..	..	..	..	2043.23
26 Hernon 36 .. ..	IX	1938.98	..	..	..	..	..	1938.98
Means .. ..	..	2802.49	2847.49	3126.26	3206.80	2741.14	2810.69	..
Necessary Differences 5% level .. ..	..	502.20	616.93	660.93	753.95	554.27	740.59	..



**TABLE**  
**OIL AND PROTEIN CONTENTS OF GRAIN**

Varieties	Percentage Oil in Grain					Percentage Protein in Grain				
	Trial 1 Buaraba Creek 1969-70	Trial 2 Buaraba Creek 1970-71	Trial 3 Lowood 1971-72	Trial 4 Too- goolawah 1971-72	Means	Trial 1 Buaraba Creek 1969-70	Trial 2 Buaraba Creek 1970-71	Trial 3 Lowood 1971-72	Trial 4 Too- goolawah 1971-72	Means
1 Davis ..	18	20	20	22	20.00	36.25	37.80	40.00	36.88	37.73
2 Wills ..	19	19	20	20	19.50	38.13	38.20	42.50	37.50	39.08
3 Leslie ..	18	20	20	20	19.50	36.83	39.20	43.13	37.50	39.17
4 Bragg ..	..	19	19	20	19.33	..	39.20	41.25	41.25	40.57
5 Hood ..	..	..	19	20	19.50	..	..	40.63	38.13	39.38
6 Dare ..	19	20	20	22	20.25	36.83	37.80	40.00	36.25	37.72
7 Gilbert ..	..	..	17	16	16.50	..	..	40.63	33.75	37.19
8 Hampton ..	..	..	20	20	20.00	..	..	40.00	38.75	39.38
9 Semmes ..	..	19	19	20	19.33	..	38.70	40.63	40.00	39.78
10 Pickett ..	..	20	20	20	20.00	..	37.80	40.63	40.00	39.48
11 Hill ..	18	19	19	21	19.25	36.83	37.10	41.25	38.75	38.48
12 Semstar ..	17	19	20	20	19.00	36.83	37.10	38.75	36.88	37.39
13 HRS 68/3 ..	..	19	..	..	19.00	..	39.80	..	..	39.80
14 Daintree ..	..	..	17	17	17.00	..	..	41.25	36.88	39.07
15 Telstar ..	15	..	..	..	15.00	37.50	..	..	..	37.50
16 Bellaire ..	15	17	..	..	16.00	37.50	40.90	..	..	39.20
17 Ross ..	..	..	18	17	17.50	..	..	40.63	37.50	39.07
18 Hinn ..	..	18	19	20	19.00	..	37.10	38.75	37.50	37.78
19 K162 ..	12	..	..	..	12.00	40.43	..	..	..	40.43
20 K44 ..	15	..	..	..	15.00	36.83	..	..	..	36.83
21 K69 ..	13	..	..	..	13.00	36.83	..	..	..	36.83
22 Hernon 36 ..	14	..	..	..	14.00	36.83	..	..	..	36.83

## National Beef Recording Scheme



THIS is the symbol of the National Beef Recording Scheme (NBRS). Producers advertising this symbol are enrolled in the scheme and care more about the breeding quality of their stock.



# Grain Sorghum Varieties for 1974-75 Season

by Officers of Agriculture and Plant Pathology  
Branches.

GRAIN sorghum varieties recommended for planting in Queensland in the 1974-75 season are listed below.

Certified seed, produced under the Queensland Seed Certification Scheme mainly by members of the Queensland Certified Grain Sorghum Seed Growers' Association on behalf of Hylan Seed Co., is as follows:—

HYBRID: Pioneer 846, Q5161, Texas 610SR, Texas 610, Texas 626, Texas 671.

NON-HYBRID: Alpha.

Seed of varieties fully recommended or recommended for trial plantings only is available as follows:—

ANNAND AND ROBINSON: Dorado, Dorado E.

DeKALB SHAND SEED CO. PTY. LTD.: E57, F64a, C42, C42t, C45, E55e.

HYLAN SEED CO.: Sunlover 1, Quicksilver 1.

PACIFIC SEEDS AUST. PTY. LTD.: Pacific 001, Pacific 007, Pacific 303, Goldfinger.

YATES SEEDS LTD.: NK133, NK200, NK207, NK212, NK233, NK266, NK275, NK300F.

OTHER SEED MERCHANTS: Alpha, Q5161; Texas 610SR, Texas 671.

In the table, no attempt has been made to rank any of the hybrids in order of preference in the various regions. Hybrids listed 'for trial'

should be planted in only small areas for testing: insufficient evaluation has been made in your region.

Should any of these varieties continue to perform well and be equal or superior to the recommended varieties, they will join or replace them in future years.

It is suggested that farmers consider planting a trial area of the 'for trial' variety or varieties. It would be appreciated if the local adviser were informed of such plantings; he will be interested in observing their performance.

It should be noted that some of the hybrids available look and yield alike and are therefore interchangeable, for example, Texas 626 and NK212, and Goldfinger and Yates NK233.

Open-headed varieties (for example, E57) are desired in regions of high humidity because of the high incidence of sorghum head caterpillars in recent years.

Under severe heat and moisture stress, the seed set of the variety NK133 tends to be low.

## Planting Rates

The planting rates quoted for many districts refer to the desirable established plant stand. To achieve this population without subsequent thinning of the stand, it is necessary to know the germination percentage of the seed and the seed size to calculate the potential number of seeds that will germinate per kilogram of seed.

From this figure, an amount to allow for field losses must be deducted. In a well-prepared seedbed under good moisture conditions, a loss of 20% would be considered normal. However, in many situations, it is often difficult to obtain a good stand so that local experience is of great importance in determining the field loss that might be expected.

Grain sorghum seed sold by the major producers is of high quality. Seed of certified varieties must have a laboratory germination of 80% or better. Seed sizes of hybrids vary so that there are generally 20 000 to 35 000 seeds per kg while seed of Alpha generally numbers 45 000 to 65 000 seeds per kg.



## SEED WEIGHTS FOR GIVEN POPULATIONS

Plants/ha	Seed (kg/ha)	
	Hybrid	Alpha
50 000 .. .. .	2.3	1.1
75 000 .. .. .	3.6	1.7
100 000 .. .. .	4.7	2.2

NOTE—For larger populations, add to these basic rates to get the desired population per ha.

### Mosaic Virus

All grain sorghum varieties now being grown in Queensland are susceptible to the Johnson grass strain of sugarcane mosaic virus. The virus is aphid-transmitted and is maintained between seasons in Johnson grass or stand-over fodder sorghum crops.

Symptoms on infected sorghum plants depend on the variety and environmental conditions. Some hybrids shows a conspicuous, red striping when infected and early infection results in severe stunting. In the following tables, hybrids susceptible to the red-stripe reaction are marked with an asterisk.

All other varieties listed produce mosaic symptoms in the form of light and dark green,

broken lines between the veins. These symptoms are more pronounced on the younger leaves of the plants.

Another type of reaction is called red-leaf and is seen on infected plants of some varieties following cool, overcast weather. The mosaic symptoms change to red spots and streaks which may deteriorate further to produce areas of dead tissue. Hybrids susceptible to the red-leaf reaction are designated with a dagger in the tables.

In some circumstances, the severe red-leaf and red-stripe diseases can considerably reduce yield. Resistance to sugarcane mosaic virus infection is at present being incorporated into some commercial breeding lines by the Department of Primary Industries.

### Head Smut

If head smut has been a problem in an area, it is advisable to plant those head smut resistant varieties (Texas 626, NK212, Goldfinger, Pioneer 846 and Texas 610SR) from the list for your district.

The recommendations that follow are basic information only; for further information, consult your local adviser.

District	Planting Time	VARIETY	Plant Population plants/ha
		E = Fast maturing M = Mid season L = Slow maturing	
Mareeba-Cooktown-Peninsula	December-January	L: E57, NK300F	75 000-100 000
Atherton Tableland	December-mid February	L: E57, NK300F	75 000-100 000
Burdekin (Townsville, Ayr, Millaroo, Bowen)	December-March	RAIN-GROWN L: E57, Alpha M: NK207 E: NK133	75 000-100 000
	March-July	IRRIGATED L: E57, Texas 671 M: Pioneer 846	160 000-250 000
Ingham	December-June	COASTAL L: E57 M: NK207	75 000
	December-January	SUB-COASTAL (less than 750 mm rain) L: E57, Alpha	25 000-30 000
Mackay (Nebo, North Broadsound)	Late December-February	L: E57, Alpha FOR TRIAL M: Q5161†	75 000-100 000

\* Varieties susceptible to the red-stripe reaction of mosaic. (All other varieties when infected show mosaic symptoms, but are resistant to the red-stripe reaction).

† Varieties susceptible to the red-leaf reaction.



District	Planting Time	VARIETY	Plant Population plants/ha
		E = Fast maturing M = Mid season L = Slow maturing	
<b>Central Coast Region</b> (Rockhampton, Alton Downs, Raglan)	Late December–February	L: E57, Alpha FOR TRIAL M: Q5161†	75 000–100 000
<b>Central Highlands</b> (Emerald, Peak Downs, Springsure, Clermont)	Mid December–mid January	RAIN-GROWN L: E57, Alpha M: Q5161† FOR TRIAL M: Goldfinger, NK233, NK266	35 000–70 000
	September–October	IRRIGATED L: E57, Texas 671, NK275 M: Pioneer 846, Texas 610SR, F64a FOR TRIAL L: E55e, Pacific 303* M: NK212, Texas 626, Goldfinger, NK233, NK266	175 000–250 000
<b>Callide–Dawson</b> (Biloela, Theodore, Moura, Baralaba, Goovigen, Wowan, Bauhinia)	Late December–early February (use mid season varieties in early February)	RAIN-GROWN L: E57, Alpha FOR TRIAL M: Q5161†, NK266, Goldfinger, NK233	75 000–90 000
	Mid December–end January	IRRIGATED M: F64a, Pioneer 846 FOR TRIAL NK266	150 000–200 000
<b>Burnett (Sub-coastal)</b> (Gayndah, Mundubbera, Monto)	November–January	L: E57, Alpha M: Q5161†, Texas 626, NK212, NK266, Goldfinger E: Pacific 007, NK233, NK133	75 000–125 000
<b>Coastal</b>	September–January	L: E57, Alpha	75 000–200 000
<b>South Burnett</b> (Goomeri, Kingaroy, Nanango, North Rosalie, Wondai)	Mid November–mid December	L: E57 M/L: Sunlover 1†, Q5161† M: NK212, Texas 626 M/E: Goldfinger, NK233 FOR TRIAL L: E55e M: NK266, Dorado	100 000–110 000
	January	VE: Dorado E* VE: Quicksilver 1	150 000
<b>Brisbane–Moreton</b> (Lockyer, Brisbane and Fassifern Valleys, Beau-desert and coastal Moreton)	September–mid January	L: E57, Alpha M: Texas 610, Texas 626, NK212, Pioneer 846 E: Pacific 007 FOR TRIAL M: C45, Goldfinger, NK233 E: NK133	100 000 (rain-grown) 250 000 (irrigated)
<b>Darling Downs</b> <b>Northern Downs</b> (Wambo, Chinchilla)	October–November <sup>1</sup> October–early December <sup>1</sup>	L: E57 M: NK212, Texas 610, Texas 610SR, Texas 626, Pioneer 846, Q5161†, Sunlover 1†, Goldfinger, NK233	50 000–100 000



District	Planting Time	VARIETY	Plant Population plants/ha
		E = Fast maturing M = Mid season L = Slow maturing	
		FOR TRIAL L: E55e M: C42t, Dorado E: Pacific 001	
<b>Central Downs</b> (Rosalie, Jondaryan, Pitts- worth, Crow's Nest, Cambooya, Millmerran)	October-mid December <sup>1</sup>	L: E57 M: NK212, Goldfinger, Texas 610, Texas 610SR, Texas 626, Pioneer 846, NK233 FOR TRIAL L: E55e M: C42t, NK266, Sunlover 1†, Dorado E: Pacific 001	75 000-100 000
<b>Southern Downs</b> (Clifton, Allora, Glengallen, Rosenthal, Stanthorpe Shires)	October-mid December <sup>1</sup>	L: E57 M: NK212, Goldfinger, Texas 610SR, Texas 610, Texas 626, Pioneer 846, NK233 FOR TRIAL L: E55e M: NK266, Sunlover 1†, Dorado E: Pacific 001	100 000 75 000
<b>Inglewood</b>	September-October	L: E57, Q5161† M: NK212, Texas 610SR, Texas 610, Texas 626 FOR TRIAL M: Sunlover 1†, Goldfinger, NK233	50 000-100 000
<b>Darling Downs All Districts</b>	IRRIGATED As for the mid season group	of varieties	250 000-360 000
<b>Border</b> (Waggamba and Balonne Shires)	September-October	RAIN-GROWN L: E57 M: NK212, Texas 610, Texas 626	50 000-100 000
	December-January	IRRIGATED M: NK212, Texas 610, Texas 626 FOR TRIAL M: C42t, Q5161†	250 000-360 000
<b>Near South West—1</b> (Shires of Murilla, Tara, Taroom)	September-October	E: Pacific 007, NK200 L: E57, Pioneer 846 M: Texas 626, NK212, Q5161†, C42t, Goldfinger, NK233	50 000-75 000
	December-January	L: E57, Pioneer 846 M: Q5161†, Texas 626, NK212, C42t, Goldfinger, NK233	
	January-February	E: Pacific 007, NK200 FOR TRIAL L: E55e M: Pacific 001	
<b>Near South West—2</b> (Shires of Bungil and Bendemere, Warroo, Booringa)	Late September-January	L: E57 M: Q5161†, C42t, Sunlover 1†, NK212, Goldfinger, NK233, Texas 626	50 000-75 000

<sup>1</sup> To avoid excessive damage by midge, planting after mid November is not advisable.



# Apple Scab Control

by J. B. HEATON, Plant Pathologist.

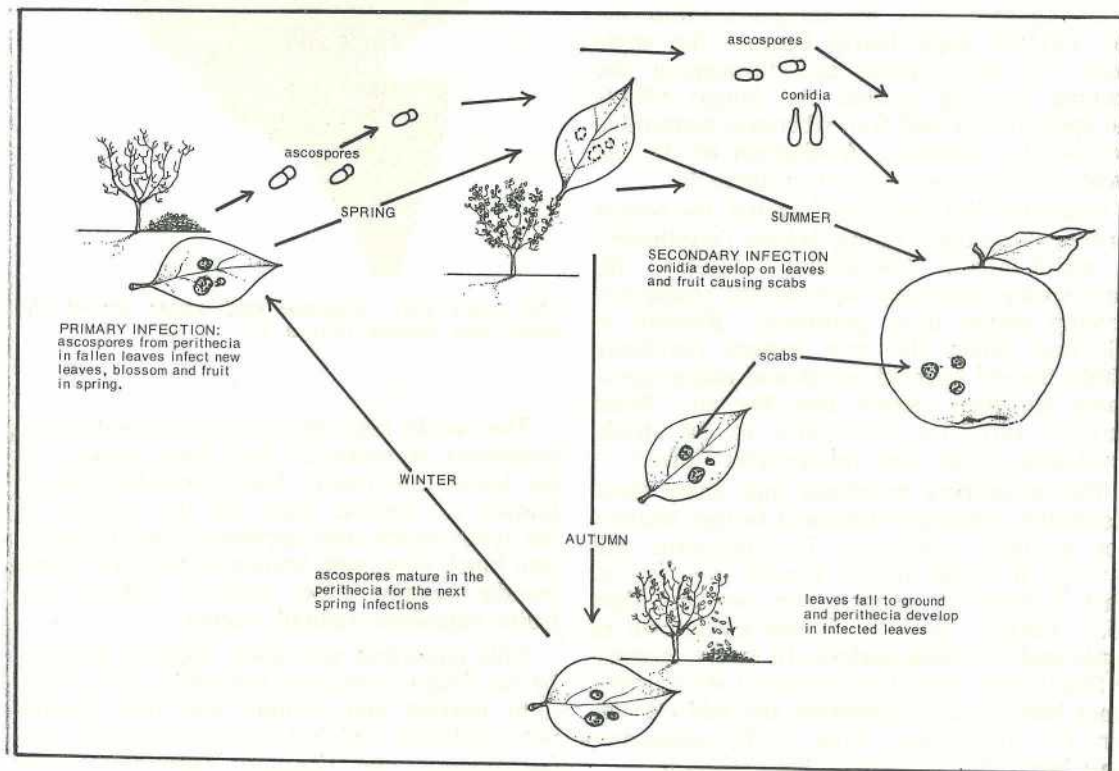
SCAB (black spot), caused by the fungus, *Venturia inaequalis* (Cooke) Wint., is the most serious apple disease in the Stanthorpe district in Queensland.

Of the commonly grown varieties, Granny Smith is most susceptible with Delicious susceptible to a lesser degree. Jonathan, Gravenstein and other varieties may occasionally be affected if an orchard should become neglected.

Satisfactory control requires a costly programme of fungicidal sprays at regular intervals to give protection from the disease at those periods when risk of infection exists.

A knowledge of the fungus causing the disease and its life cycle in apple trees will help growers to get the best results from a control programme.

Apple scab life cycle diagram (figure 1).



## Symptoms

The disease attacks blossom, leaves, fruit and, rarely, twigs.

Black patches may develop on the flower stalk which often withers, causing the blossom to blacken and die.

Leaf spots, however, are generally the first symptoms seen. On very young leaves, a diffuse, velvety growth develops irregularly on the lower surfaces. On the upper surfaces of older leaves, light, olive-green spots about 3 mm in diameter appear. These spots darken to a brown and then black colour. There may be only a few spots or so many that they often coalesce and cover almost the entire leaf surface (figure 2). With age, the spots become scabs.

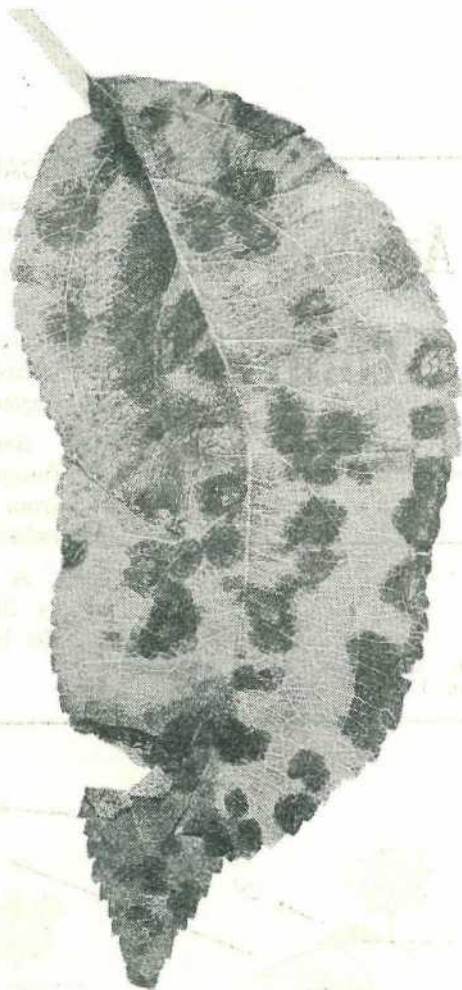
Fruit scabs begin as small, dark spots on the skin. These enlarge, becoming brown and corky in the centre with black broken margins (figure 3). The presence of scabs on the apple lowers the quality of the fruit, and in severe cases may render it unmarketable.

## The Disease Cycle

During winter, the fungus grows within the old, infected apple leaves beneath the apple trees. In early spring and throughout the summer growing season, the fungus infects the apple foliage and fruit whenever favourable wet weather prevails. A diagram of the life cycle of the fungus is given in figure 1.

Soon after leaf fall in early winter, the fungus forms microscopic fruiting bodies (perithecia) in which spores (ascospores) develop. By early spring, enormous numbers of ascospores develop within these perithecia. Rainfall at this time soaks the now mature perithecia within the old infected leaves and many ascospores are then ejected into the air. Wind currents carry the ascospores to the newly developing apple tree foliage and flowers.

The ascospores germinate and infect these susceptible apple tree tissues if further warmer wet weather continues. The infection will develop if apple leaves remain wet for at least 9 hours at temperatures not less than 16.5° Celsius. Such conditions are known as **apple scab infection periods**. In recent seasons, at Stanthorpe, these have occurred six or seven times between late September and mid December. By midsummer, most of the ascospores have been discharged from the perithecia.



*The spots may coalesce and cover almost the entire leaf surface (figure 2).*

Two weeks after infection by the ascospores, symptoms of scabs or dark spots appear on the leaves and fruits. Dark secondary spores known as conidia grow on the surface of the scabs which then appear as the characteristic black spots well known to growers. These conidia readily infect adjacent foliage and fruits whenever rainfall occurs.

This important secondary stage of infection by the fungus continues throughout the season until harvest and autumn leaf fall. Humid wet conditions which occur at Stanthorpe during January and February especially favour

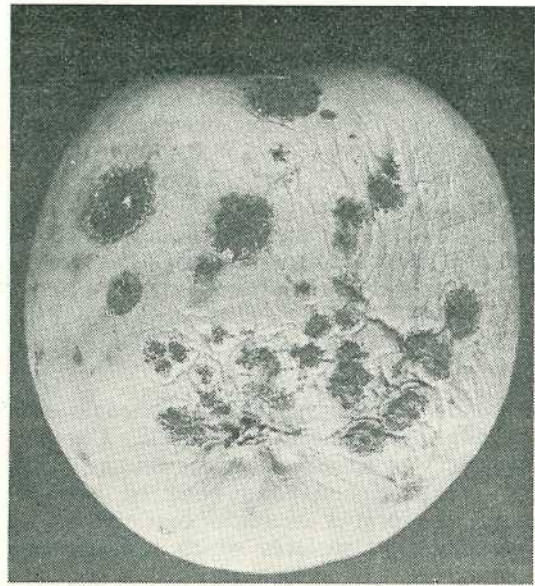


this secondary 'black spot' infection. After leaf fall in autumn, the fungus resumes its winter growth stage again and begins to develop perithecia in the infected leaves.

### Current Research

Investigations by the Department of Primary Industries since 1970 have resulted in some new fungicidal recommendations for apple scab control, and the commencement of an apple scab warning service.

Several fungicides, tested and found to give good disease control, appear in the control schedule below. In the investigations, complete cover sprays were applied to the test trees at 1 378 to 1 722.5 kPa (200 to 250 p.s.i.). Fungicides found to be equally satisfactory were benomyl (0.0125 or 0.025%), captan (0.1%), dodine (0.03 or 0.045%), mancozeb (0.12%), and thiophanate-methyl (0.07%). Some other new fungicides gave good disease control but caused severe fruit russet.



*Fruit scabs lower the quality and, in severe cases, may make the fruit unmarketable (figure 3).*

### CONTROL SCHEDULE

Time of Application	Treatment	Remarks
Green tip .. .. .	Bordeaux 10-10-100 OR copper oxychloride 2.3 kg/45.5 litres (5 lb./100 gal.) OR benomyl 0.025%	
Pink .. .. .	Organic fungicide:— Any of these:— benomyl 0.0125% captan 0.1% dodine 0.03% mancozeb 0.12% mancozeb-dinocap 0.12% thiophanate-methyl 0.07% thiram 0.12% ziram 0.12%	10% blossoms out
Blossoming .. .. .	Organic fungicide as above.	10 days later than previous spray
Late calyx .. .. .	Organic fungicide as above.	Apply when 95% petals fallen
Early November .. .. .	Organic fungicide as above.	Two weeks after previous spray
Late November— harvest (every 2-3 weeks)	Organic fungicide as above.	
Autumn .. .. .	Benomyl 0.025% .. .. .	Pre-leaf fall spray to eradicate overwintering of infection

Rates of fungicide per 455 litres (100 gal.) of spray are as follows:—benomyl (50% W.P.) at 0.0125% and 0.025% are 113 g and 227 g respectively; captan (83% W.P.) at 0.06% and 0.1% are 339 g and 567 g respectively; dodine (65% W.P.) at 0.03%, 0.045% and 0.06% are 227 g, 340 g and 454 g respectively; mancozeb (80% W.P.) at 0.12% is 681 g; mancozeb-dinocap (80% W.P.) at 0.12% is 681 g; thiram (80% W.P.) at 0.12% is 681 g; thiophanate-methyl (70% W.P.) at 0.07% is 454 g; zineb (65% W.P.) at 0.065% is 454 g; ziram (80% W.P.) at 0.12% is 681 g.

The fungicides in the control schedule are protectant or eradicant chemicals. Captan, mancozeb, mancozeb-dinocap, thiram and ziram are protectants and must be applied regularly to form a chemical barrier on the foliage and fruit surfaces which will prevent the germination of any spore on that surface. However, other fungicides such as benomyl, dodine and thiophanate-methyl are eradicant chemicals which are able to destroy new scab infections or suppress established infections. This eradicant action takes place provided such chemicals are applied to the apple trees soon after an apple scab infection period has occurred. Dodine (0.045% to 0.06%) applied within 2 days, or benomyl (0.025% applied within 4 days will eradicate new scab infections.

### Apple Scab Warnings

Until recently, growers have controlled apple scab by regularly using protectant fungicides according to the control schedule. Eradicant fungicides have generally been used only if a disease outbreak occurs, or if prolonged rainfall interrupts orchard spraying.

During the 1973-74 season, apple scab warnings were issued by the Department whenever an apple scab infection period occurred. These included advice whether to apply a protectant or an eradicant fungicide in order to assist growers obtain better scab control when using the control schedule.

Regular spraying is essential from October to late December when up to seven apple scab infection periods may occur if summer rains are favourable for the disease. The biology of the fungus during the unfavourable conditions of a dry summer has yet to be studied. Apple scab control may then prove to be possible solely by eradicant spraying after scab warnings.

However, rainfall during a dry summer may be restricted at times to a few localities. In this case, the occurrence of apple scab infection periods will be limited also to these localities, and no general district warnings will then be possible.

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## Barley prospects bright for 1974-1975

FIRST estimates of this season's barley planting intentions of 165 000 hectares appear to be the best recorded since 1969-70 season.

Last season, it is estimated that 129 500 ha were harvested, to give a crop of approximately 217 700 tonnes.

Announcing this, the Minister for Primary Industries (Hon. V. B. Sullivan, M.L.A.) said the extent of the early plantings augured well for a large percentage of the harvest being of malting grade.

He added that, should favourable growing conditions follow on the good subsoil moisture at planting, yields could be above average.



# The Clapp Flood Fence

by R. B. CLAPP, Surfers' Paradise; and W. E. M. ROTHWELL, Sheep and Wool Branch.

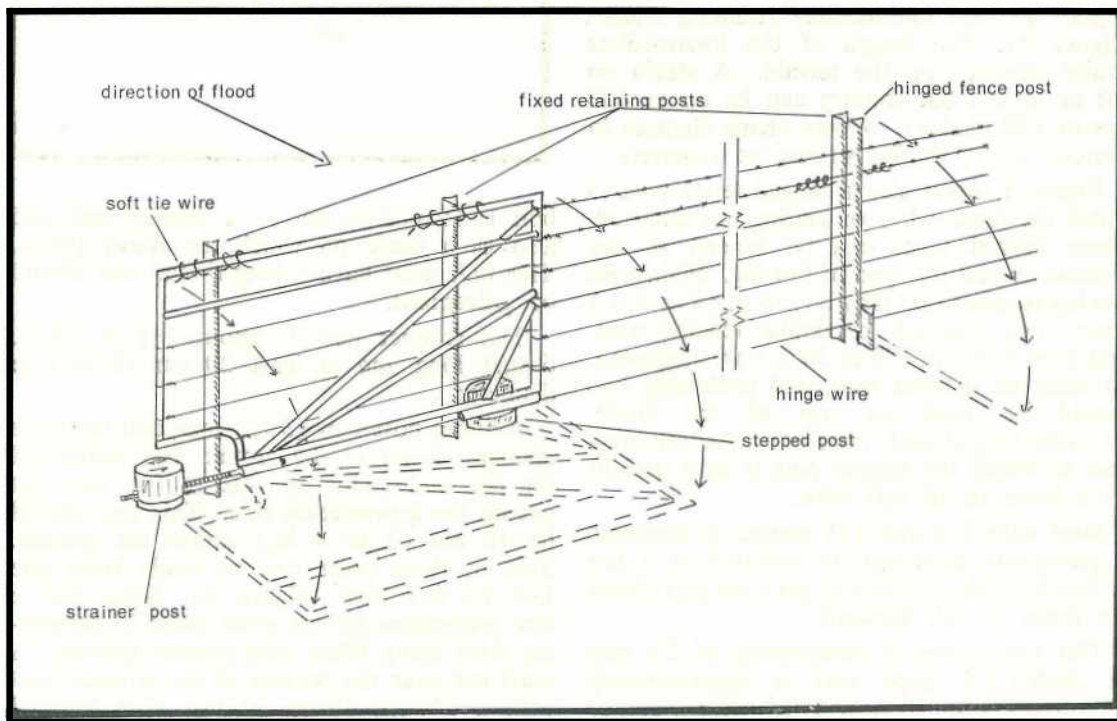
A flood fence that gives under the weight of flood water, but does not break, and can be restored readily after the flood subsides can be built by any grazier.

This is the Clapp flood fence that was designed to meet a continuing problem on my property on the Dumaresq River near Bonshaw, N.S.W.

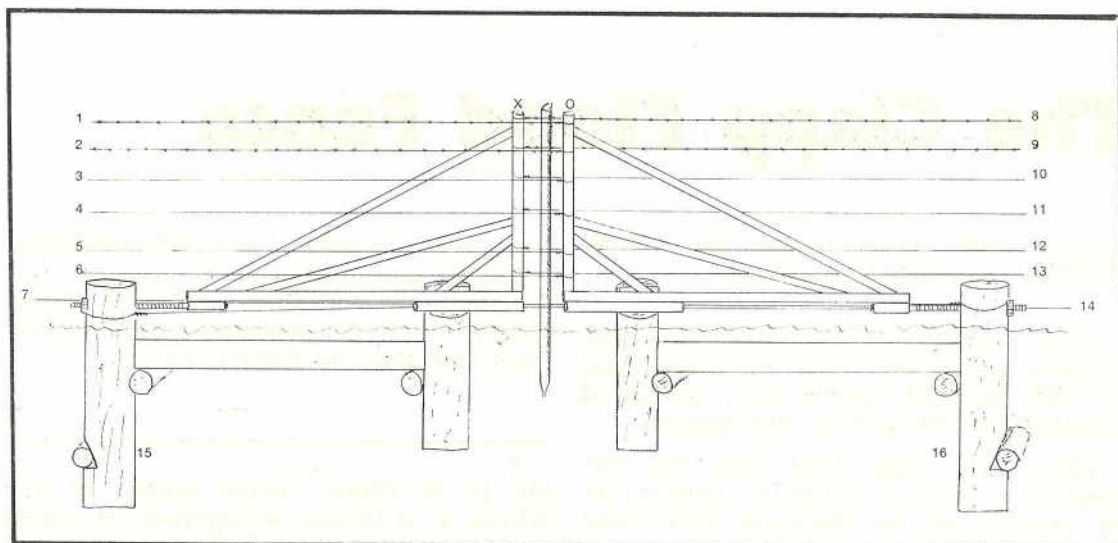
The fence consists of a number of sections which are capable of yielding independently to the pressure of flood, and which can be re-erected quickly and easily because tension is maintained whether the fence is upright or

down. It can be adapted to fit many situations. It can be made to extend for miles on river flats or to replace flooded sections of existing fencing or to form a continuation of a standard fence that abuts on flooded country.

Mr. R. B. Clapp, senior author of this article, is a former woolgrower of 'Langi Oonah', Bonshaw, N.S.W. He designed and patented his flood fence after many standard fences on his property had been swept away by floods in the Dumaresq River.



End frame and fence post (figure 1).



ABOVE. Intermediate straining frame and underground assembly looking upstream (figure 2).

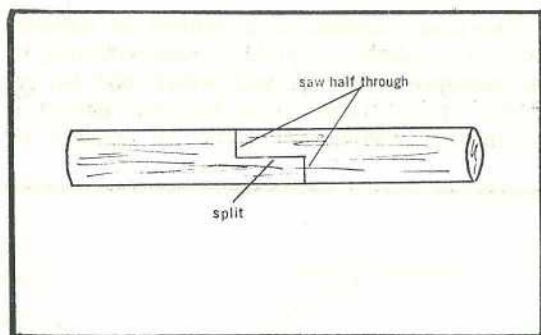
RIGHT. Two stepped posts can be made from one log (figure 3).

Tension is maintained by an end frame (figure 1) and intermediate straining frames (figure 2). The length of the intermediate strains depends on the terrain. A strain on flat or almost flat country can be up to 400 metres (20 chains). Where sharp changes in contour occur, shorter strains are required.

Figure 1 shows also a hinged fence post to which the fence wires or netting are attached. These hinged posts can be spaced at any distance to suit the type of fencing. Plain wire fencing requires that they be 2.5 m (8 or 9 ft.) apart. For 'ringlock' or similar fencing spacings from 6 to 9 m (20 to 30 ft.) are suggested. At least one barbed wire, and preferably two should be used on top of the fence. At every hinged post, there is a fixed retaining post to which the hinged post is held upright by a loose tie of soft wire.

Steel wire 2.8 mm (11 gauge) is adequate if previously annealed or softened in a fire so that it yields at sufficient pressure and allows the fence to fall forward.

The end frame is constructed of 25 mm (1 inch) i.d. pipe and is approximately 2.5 m x 1.2 m (8 ft. x 4 ft.) with a corner cut away where a 20 mm ( $\frac{3}{4}$  in.) threaded



bolt is located to act as a tension bolt and also as a hinge on which the frame pivots. This bolt must have a long thread and should be galvanized.

The strainer post is about 1.4 m (4 ft. 6 in.) long and at least 20 cm (8 in.) in diameter.

Another post 1 m (3 ft.) long and the same diameter is set in the ground and positioned for the end frame to rest in the step cut out on the downstream side. This step should be 10 cm (3 or 4 in.) above the ground. Two of these posts can be made from one 1.8 m (6 ft.) post (figure 3). Note that a few projections on the posts assist in preventing their being lifted from sodden ground. A scarf cut near the bottom of the strainer post with a 25 cm (8 to 10 in.) slab inserted crossways gives added resistance against lifting.



## Anchors

Underground, between these two posts, runs a heavy rail, the ends of which are butted against the posts and rest on slabs or short pieces of wooden post. These underground timbers share the strain and act as anchors. The underground assembly is shown in figure 2.

On the bottom of the end frame, a piece of 25 mm (1 in.) pipe about 10 cm (4 in.) long is welded. The tension bolt passes through this to the strainer post and the end frame is free to turn on it. At the opposite end, a piece of the same pipe about 40 cm (16 in.) long is welded to reinforce the section of the end frame where it rests on the stepped block. The frame is held to two fixed retaining posts by lengths of soft wire in the same way as the hinged posts.

The intermediate straining frame (figure 2) is similar in its action to the end frame and is constructed of the same 25 mm (1 in.) pipe. The stays on both frames may be made of 15 mm ( $\frac{1}{2}$  in.) diameter pipe. The underground assembly, the tension bolt assembly and the reinforcement on the stepped posts are the same as for the end frame. The uprights on the intermediate frames and their strainer posts are about 2.5 m (9 ft.) apart.

Note that wires 1 to 6 run in front of frame X and tie to frame O while wires 8 to 13 pass behind O and tie to X. Hinge wire 7 is tied to the strainer post on previous section to the left, runs past strainer post 15, through frames X, O and ties to strainer post 16. Hinge wire 14 runs from the strainer post on the next section to the right, past strainer post 16 through frames O, X and ties to strainer post 15.

Separate ties of softened wire are used to hold the pair of intermediate frames to a retaining post. These ties allow the sections to fall independently of each other.

It is important to note that both figures are shown from the downstream side and that the left of the figures is towards the main stream, so that frame O with wires 1 to 6 will fall before frame X with wires 8 to 13.

The hinged fence post is made from a 1.7 m (5 ft. 6 in.) star steel post, cut in two between the bottom two wire holes. The stub, about

45 cm (18 in.) long is driven into the ground leaving about 10 cm (4 in.) above ground. The hinge wire runs through the hole in the stub to register with the bottom hole of remaining part of the steel post which forms the 'dropper'. Wooden posts could be used in place of steel for these hinged posts and stubs.

The fence should be constructed in the 'down' position and with all the tension bolts fully extended. To strain the fence, a winch as used on the front end of a four-wheel drive vehicle is ideal. Where long strains are used, it is essential to see that the fence is free to slide along the ground. Tussocks and small stumps can prevent an even strain through to the far end.

Rabbit netting is better than plain wire or a 'ringlock' type fence as it offers far more resistance and drops earlier.

## Cost

The cost of this flood fence will vary depending on the price of materials in different districts and whether the welding can be done on the property.

Initially, the cost will be greater than for a standard fence, but the permanent saving lies in its easy restoration, stock-proof and undamaged, after a really bad flood in which an ordinary fence could be washed away and require complete replacement.

After every flood over the Clapp fences, it has been necessary only to stand the fence up and to do a few minor repairs. The saving in labour, material and wandering stock after a flood will soon pay for the extra cost of this first class improvement.

Other uses for the fence will suggest themselves as time goes by. Examples are passage for wide farm implements, mobs of ewes and lambs and fire trapped animals, and also to avoid boggy and waterlogged gateways.

If there is plenty of warning before a flood the fence can be dropped and left in the down position until the flood has passed. Stock respect this fence because it acts like the well known suspension type baffling stock because of its 'spring'.

The fence will restrain cattle, horses, Border Leicester rams and even children's ponies.



# Kangaroo Harvesting and Survival

THE larger macropod marsupials including the red kangaroo, the grey kangaroo, and the wallaroo have been shot as pests, for sport and for profit since the early days of European settlement.

It is only comparatively recently, however, that legislation has been enacted to make supervision and control of these activities possible. The relevant Queensland legislation, *The Fauna Conservation Act of 1952* (soon to be replaced by *The Fauna Conservation Act of 1974*) makes provision for the declaration of open seasons on certain fauna. At present, these three species (and five others) may be taken throughout the year by persons in possession of the necessary permit.

Administration of the Act is in the hands of the Fauna Conservation Branch of the Department of Primary Industries, which thus has the responsibility for 'the Conservation, Propagation, Care and Protection in Queensland' of all fauna including the kangaroos.

One of the most conspicuous problems under this charge is to ensure that continuance of the open season on kangaroos does not at any time endanger their survival. This paper gives an account of the way the Branch handles this problem, and explains how and why the commercial harvesting of kangaroos has been permitted to continue to the present.

## Does Harvesting Lead to Extinction?

The first question to be answered is whether it is possible to harvest a wild animal without causing it to become extinct.

Although it is frequently stated by animal protection groups that commercial exploitation of a wild animal leads inevitably to its extinction, this is simply not true. Certainly throughout the world many animals have become extinct, and some of these were commercially exploited. Just as certainly many species have survived and thrived despite, not only commercial exploitation, but even extermination campaigns.

The real explanation of changes in the abundance of any species lies in its capacity to adapt to the environmental changes to which it is subjected, particularly those caused by man.

Most animals are adaptable enough to survive in the presence of man, although most suffer to some degree. The most successful animals today are those that benefit from such man-induced changes as they experience. The least successful are species with a narrow capacity to resist environmental pressures, which is commonly indicated by a limited distribution. These are in the greatest danger from man's activities.

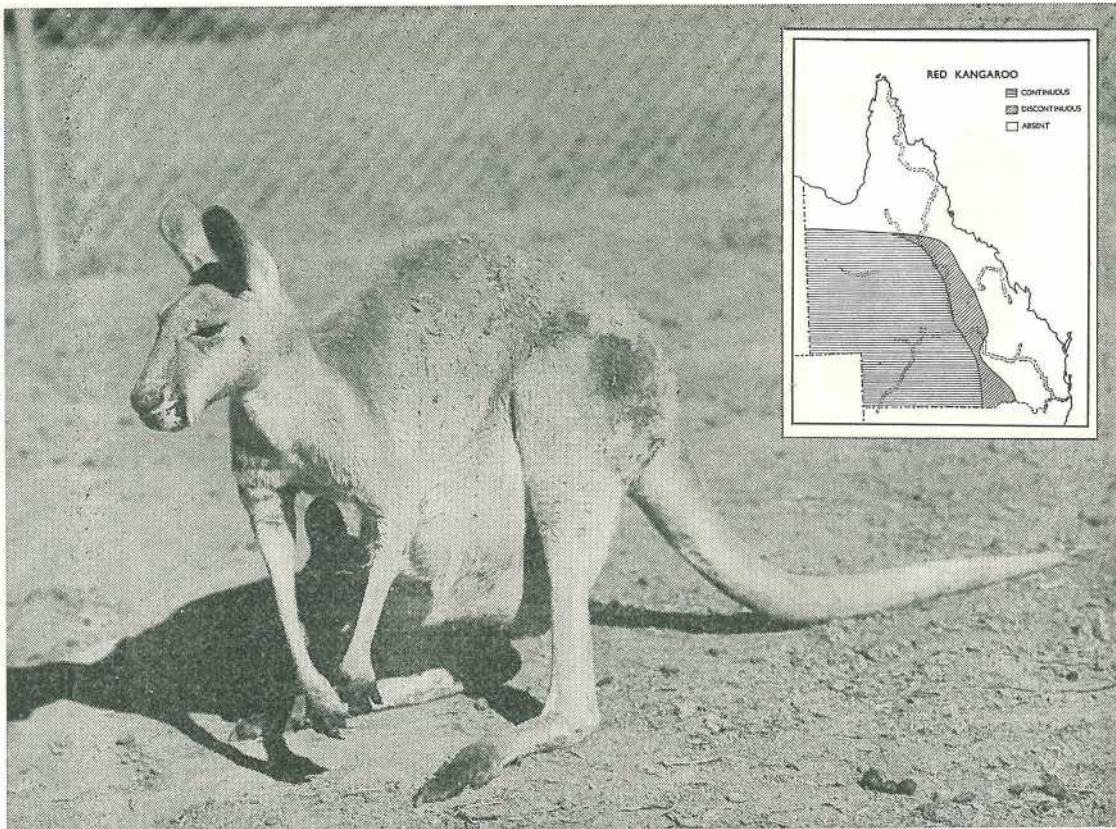
The opportunity to take a harvest from a wild animal population is provided by its reproduction. If the birth-rate of an animal exceeds its natural death-rate then a surplus is available for man or some other predator. It is hardly necessary to point out that in any animal, even a slow-breeding species like man, the reproductive capacity is vastly in excess of what is needed to maintain the population.

An important question immediately arises: why is it that populations of the great majority of wild animals in their usual habitat obviously remain fairly stable from year to year? If this indicates that the death rate does, in fact, match the birth rate, how can there be any surplus for man to harvest? It is at this point that some understanding of population dynamics is required.

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by T. H. KIRKPATRICK, Fauna Conservation Branch.





*The red kangaroo and its distribution in Queensland.*

The broad fact that death rate normally equals birth rate is true for most animal populations, but this is so because the natural environment is normally saturated with the adults, and young survive beyond weaning only in numbers sufficient to keep pace with adult deaths. It follows therefore that if the adult death rate is increased (by, say, harvesting) then the survival rate of the weaned young is likely to increase in response. If this happens, it further follows that adult removal may safely continue to the point where it is just compensated for by increased juvenile survival. If the harvesting rate continues to increase beyond this point, however, over-exploitation will occur.

This is the basis on which the safe harvesting of wild animals has occurred in the past, whether those doing it understood it or not. Today, when governments regulate harvests, harvesting may be safely permitted when these principles are appreciated, provided

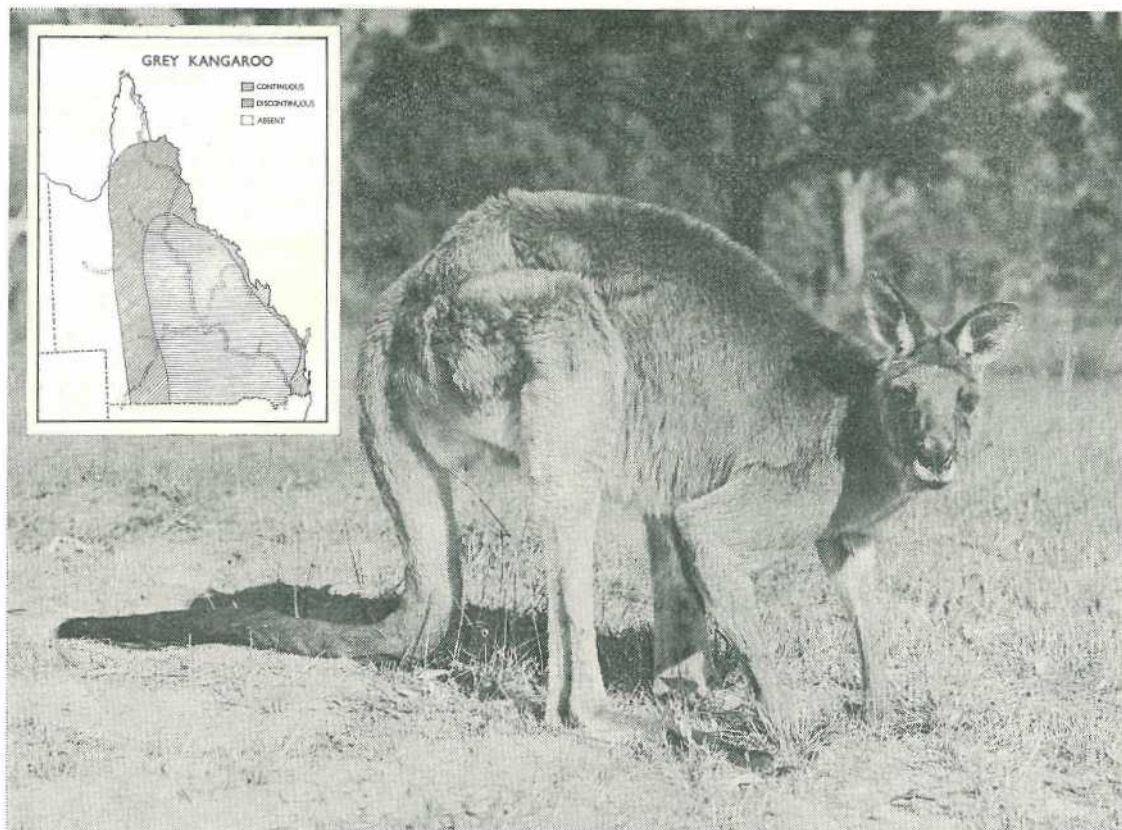
the permitting authority does not allow over-exploitation to continue to a stage where irreversible damage is done to the base population, and provided also the habitat of the exploited population is not adversely altered. To enable proper control to be exercised, an operation known as population monitoring is required. This is discussed below.

### **Kangaroos' Response to Man**

This leads to the question: what is the status of the large kangaroos?

The three large kangaroos in Queensland are, without any question, among the native animals that have responded most successfully to the presence of man and his environment-altering activities.





*The grey kangaroo and its distribution in Queensland.*

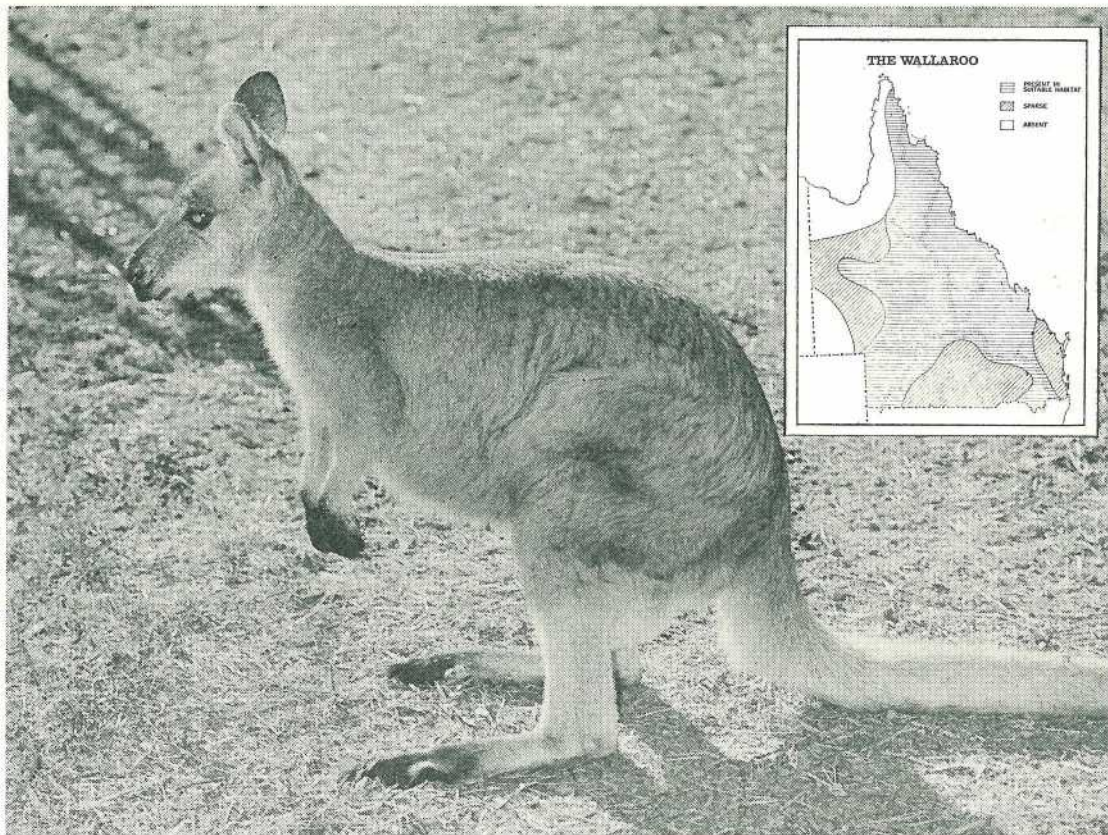
When Europeans first settled Australia, kangaroos were widespread but not particularly abundant, as the diaries of the early explorers clearly show. But today kangaroos, particularly in Queensland, are as widespread as they have ever been and can only be described as abundant throughout the greater part of their range.

The simple explanation of the difference is that the environmental changes wrought by pastoralists, involving the clearing of forests to improve pastures, have favoured not only the introduced stock for which the changes were made, but the large native herbivores, the kangaroos, as well. Indeed, the increases in kangaroo populations that followed development of the pastoral industry were recognized by Governments throughout Australia as creating such a pest problem for graziers that kangaroos and their kin were officially declared

vermin, government bounties were paid for their destruction and a demand for the control of 'marsupials' was a condition on Government-granted pastoral leases.

The fact that these practices have been discontinued in Queensland, where the last bounties on kangaroo scalps were paid in 1946 and where kangaroos were taken off the list of pest fauna in 1952, does not mean that the problem no longer exists. Rather, it indicates that a better way of dealing with the situation has been found, involving the declaration of open seasons on species with a recognized pest potential, and permitting controlled harvesting of those species by commercial interests.





*The wallaroo and its distribution in Queensland.*

### **Commercial Harvesting**

How is the commercial harvesting of kangaroos controlled?

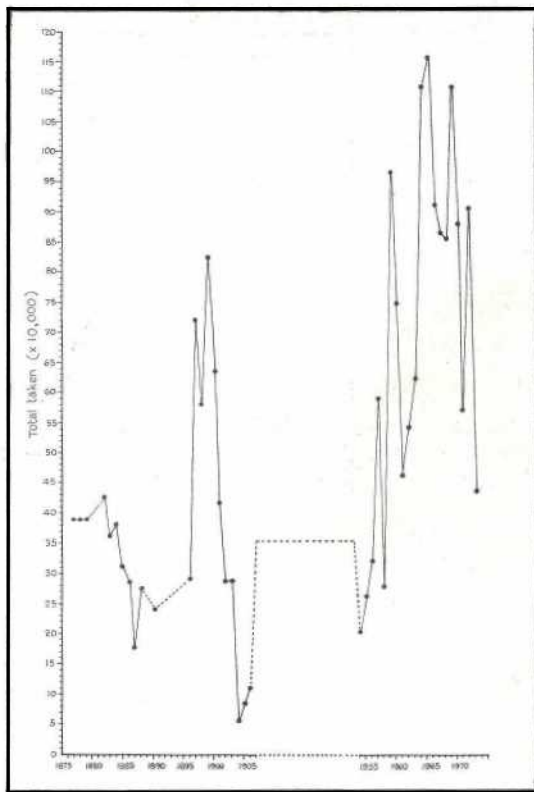
When *The Fauna Conservation Act* of 1952 was proclaimed, the principle of controlled harvesting of kangaroos rather than the encouragement of their destruction as pests was introduced for the first time in Australia.

Power was given under the Act to the administering authority to introduce regulations to control the harvest and prevent over-exploitation whenever and wherever deemed necessary. The first regulations, introduced when the Act became law in 1954, declared an open season throughout the year for eight members of the kangaroo family including the three of significance to the industry, the red kangaroo, the grey kangaroo and the wallaroo.

Among other things the regulations required that shooters and dealers handling the harvest be licensed and that a royalty be paid on every kangaroo taken for sale. Shooters applying for a permit (which, if granted, is for the calendar year unless cancelled sooner) were required to declare the properties on which they intended to operate; dealers were required to provide a monthly record of the numbers, by species, of their purchases and the names of their suppliers.

Permits for both intrastate and interstate movements of kangaroos, whether as skins or carcasses, were required from dealers and shooters.





Annual harvest of the three large kangaroos in Queensland (see text).

As the kangaroo meat industry developed during the 1960s, and with it the numbers of shooters and the size of the harvest increased, further regulations were introduced. These placed an upper limit on the number (80) and capacity (45 cubic metres) of carcass buying points (chillers) and limited the minimum distance between them to 80 km.

Relocation of a chiller was allowed only with permission from the fauna authority. Commercial shooters were also required to keep a register, by species and number, of all sales and payments of royalty, to be made available on demand by a fauna officer.

Fees were charged for all permits issued under the Act, and appropriate penalties including revoking of permits and payment of fines were provided for non-observance of the regulations.

The effectiveness of the regulations, from the points of view of both ease of enforcement and survival of populations of harvested species, are under constant review by administrative and research staff of the Fauna Conservation Branch. As the need for new regulations is established the necessary steps are taken to have them introduced. Permit fees were increased considerably and further controls introduced from January 1974. One of the most important activities in this connexion is population monitoring.

### Population Monitoring

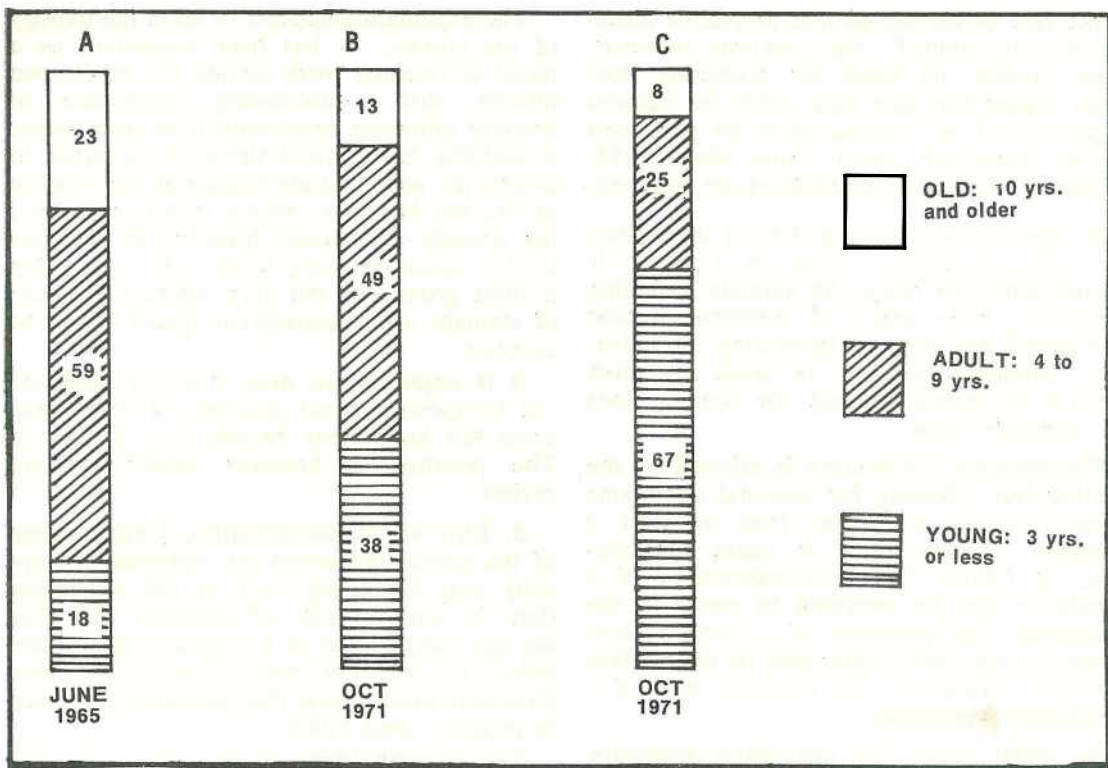
What is population monitoring, and how is it done?

Theoretically, to ensure that over-exploitation of a wild animal does not occur, all that is needed is a knowledge of the total population present at a given time, the potential birth rate and the way the birth rate is modified by environmental pressures (such as drought and flood), the accidental death rate and the death rate caused by non-human predators in all age classes of the population. Armed with this knowledge, a safe harvesting programme may be designed, and its effectiveness checked (monitored) by regular counts.

Unfortunately, although much of the biological information is known for kangaroos, the first requirement, a census, is simply not possible. Not only is the area involved (at least 400 000 square miles) so large as to be beyond the resources of any organization to examine, but practical counting methods are not available. It is true that kangaroos in open country may be counted from low-flying aircraft and, at certain times of the day, kangaroos may be counted from a moving vehicle on the ground, but by far the greater part of kangaroo habitat is totally unsuitable for aerial survey. No one has ever provided a satisfactory correlation between the numbers actually present, the numbers counted from a vehicle on one day and the numbers counted on any other day from the same vehicle moving over the same path.

It follows, therefore, that practical alternative techniques are needed to acquire data from which the status of exploited populations may be inferred rather than known absolutely. In Queensland, those used are of three kinds.





Examples of age composition of samples taken from grey kangaroo populations. Histograms show age group percentages.

A—Shooters' sample from a population unexploited for the previous 5 years (near Mitchell).

B—Shooters' sample from a population safely exploited for 6 years (near Mitchell).

C—Shooters' sample from an over-exploited population (near Roma). This area has become extensively agricultural in recent years and kangaroo harvesting has practically ceased.

1. THE SIZE OF THE ANNUAL HARVEST OF EACH SPECIES. In dealing with kangaroos, the Branch has the advantage of having detailed species records, acquired under the Act, of the harvest from 1954 to the present. Records are also held of the total taken for bounty purposes between 1877 and 1906, with an estimate of the harvest in the intervening period.

These records provide positive proof of the capacity of the exploited populations to sustain at least the actual harvests taken. It may be argued that some risk may have been involved in allowing the harvest to go so high during the 1960s (the harvesting was under

surveillance, however, using other methods detailed below). Nevertheless the fact that an average harvest of some 850 000 kangaroos has been maintained for several generations of kangaroos, and including a number of drought years (when the reproduction rate of all kangaroos falls off), demonstrates beyond doubt the capacity of the populations involved to sustain a harvest of at least that size over the wide range of weather conditions so far encountered.

On its own, therefore, a continuous record of the harvest provides a sound basis for future control of exploitation now that a safe harvesting level has been established. The technique may be used to detect any significant increase

in the rate of harvest so that corrective measures may be applied. These records, however, alone provide no basis for predicting how much higher the take may safely be allowed to go and, if an increase is to be permitted as has happened several times since 1954, additional monitoring procedures are required.

**2. SPECIES DISTRIBUTION.** One of the earliest signs of a population decline in a species is a reduction in its range. All animals, including kangaroos, have areas of preferred habitat surrounded by areas of decreasing attractiveness, ultimately reaching to areas in which survival is impossible and the species does not normally occur.

The marginal distribution is affected by the weather but, allowing for seasonal conditions when a species disappears from an area it normally inhabits, there is cause for concern. It follows that over-exploitation of a population can be expected to result in the unseasonal disappearance of a species from its usual range, and regular data on distribution are thus a valuable, and essential, part of a monitoring programme.

As noted above, the regulations governing the kangaroo harvest in Queensland require that purchasers of kangaroo skins and/or carcasses detail purchases and their suppliers in their monthly returns. As shooters are required to list the properties on which they operate in their application for a permit, a large part of the information required to follow any change in the distribution is available. Further, both research and other field officers of the Branch, during their frequent field operations, are alert for any apparent change in the distribution pattern of exploited species.

To date, no change in species range that may reasonably be related to exploitation has been detected. The several species are still being seen and taken in their traditional districts, with all three together in more than half of the State.

One significant change that has been observed, however, has occurred over the last 20 years or so and involves the apparent westward spread of the grey kangaroo coupled with a decreasing significance of the red kangaroo in the areas where the grey has increased.

The explanation appears to be in the biology of the species. It has been suggested, as a result of research work carried out by Branch officers, that a decreasing significance of drought following improvement in stock water availability has allowed the grey kangaroo to extend its range and abundance at the expense of the red kangaroo, which is better adapted for drought and ceases breeding in response to dry conditions long before the grey. Thus it loses ground to the grey where the effects of drought are effectively mitigated by water supplies.

It is important to note, however, that the red kangaroo has not disappeared from these areas but has merely become less significant. The position is, however, under constant review.

**3. BIOLOGICAL MONITORING.** Consideration of the earlier discussion on reproductive capacity and harvesting lead to the suggestion that the survival rate of juveniles and thus the age composition of a kangaroo population reflects the degree of exploitation it experiences. Research work to test this possibility has been in progress since 1964.

The theory is simple enough. An unexploited population would be expected to include a high proportion of old animals relative to young. A shooter moving into such an area would be expected to take, initially, mostly large animals. Size in kangaroos is related to both age and sex: the oldest are the largest, and a male is larger than a female of the same age. Provided his rate of harvest was safe (that is, not over-exploiting), the age composition would be expected to change to a lower proportion of old to young, finally stabilizing at some time in the history of exploitation.

An excessive rate of harvest, however, would result in a continuously decreasing ratio of old to young, coupled ultimately with a decrease in actual harvest size. At the same time, a change in the sex ratio of the population would be expected.

It follows that these changes would be reflected in the age composition of the harvest taken by the shooter, which is highly biased because of the selective nature of his operations, and also of a sample taken from the population as a whole without any attempt



at selection. In fact, changes of this nature have been detected in both kinds of samples taken from kangaroo populations in Queensland. The overall position has been under review using shooters' samples since 1968.

It is not yet possible to quantify results, that is, an age composition of either a shooter's sample or a research sample cannot yet be said to indicate a particular stage in over- or under-exploitation. Nevertheless, in the absence of a positive mathematical formula, the status of the population may be determined from the trend. That is, a decreasing proportion of old to young in successive samples suggests at best a position not yet stabilized, at worst a population in the process of over-exploitation: fluctuations are normally explained in terms of seasonal conditions.

Significantly, however, the results for the whole of Queensland have not yet indicated any definite adverse trend. Rather, they have supported the inferences drawn from harvest size and distribution data that the overall exploitation rate of all three species has been at least safe.

Once the mathematical problems involved in interpreting the data quantitatively are overcome, however, it will be possible to indicate, for example, that an increase in the harvest would do no harm and even to state by how much the harvest might safely be increased.

## Policy on Harvesting Kangaroos

What is the current policy on kangaroo harvesting?

For the moment, the stand has been taken that the rate of exploitation that has proved safe over the last 15 years will be permitted; involving the application of the regulations of *The Fauna Conservation Act of 1974* to maintain the *status quo*.

The monitoring programme involving the collection and analysis of data on harvest size, distribution pattern and age composition will continue to ensure that any harmful changes in either the exploitation rate or the status of exploited populations are quickly detected and rectified, if necessary, by the proper exercise of the wide powers available under *The Fauna Conservation Act of 1974*. Particular attention will continue to be paid to the kind and extent of future environmental changes in kangaroo habitat caused by man as these will be the most likely possible cause of any detected alteration in the status of exploited populations.

Finally, and most importantly, research work into the biology and population dynamics of Queensland's large kangaroos will continue to enable administration of the State's fauna conservation laws to be pursued in the light of as much biological and ecological knowledge of the species as possible.

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## Wheat quotas unchanged

FOR the 1974-75 season, allocation of wheat growers' basic quotas will be the same as in 1973-74, Primary Industries Minister (Hon. V. B. Sullivan, M.L.A.) announced recently.

Mr. Sullivan said that the delivery quota for Queensland this season of 1 176 000 tonnes was the same as last year.

Both the State Wheat Board and the Queensland Grain Growers' Association had advised that the method of allocating these quotas would not be changed.

# Brigalow Sucker Control by Burning



▲ An area where the brigalow suckers were misted, burnt 2 years later and then misted again. Note the almost complete control of brigalow. An untreated area is in the background.

Brigalow suckers similar to the unburnt suckers in the trial before misting. ♣



# and Misting

by P. V. BACK, Botany Branch.

**BURNING** before misting brigalow suckers can markedly increase the kills obtained.

In a trial on the Brigalow Research Station, near Theodore, burning brigalow suckers before misting with 2,4,5-T gave a 300% to 400% increase in the kill. When old suckers were misted, burnt 2 years later and misted again 5 months after burning, an 80% to 90% kill resulted.

### **Trial Site**

The trial was located on an area of brigalow-belah scrub which was pulled in September-October 1963. The pulled scrub was burnt

in December 1963 and sown to a mixture of Rhodes, green panic and buffel grasses. The burn was a poor one and an attempt was made to reburn the area in March 1966. Because of dense sucker regrowth and a general lack of fuel, the burn was again poor with patches of burnt and unburnt suckers scattered throughout the area.

### **Treatment**

It was then decided to treat the area chemically using 2,4,5-T ester applied with a tractor-mounted misting machine.

Two rates, 0.56 kg and 1.12 kg acid equivalent (a.e.) per hectare of 2,4,5-T were used in two different carriers, diesel distillate



and water. The total amount of mixture applied per hectare was 45 litres. This resulted in areas of burnt and unburnt suckers being misted using three different chemical treatments.

The chemical treatments were:—

1. 0.56 kg a.e. per hectare 2,4,5-T in 45 litres of diesel distillate
2. 1.12 kg a.e. per hectare 2,4,5-T in 45 litres of diesel distillate
3. 1.12 kg a.e. per hectare 2,4,5-T in 45 litres of water.

A mister mounted on the three-point linkage of a tractor was used to apply the mixture. Ten-metre swaths were covered with each run and a forward speed of 5 km per hr was maintained. Plots 200 m by 100 m (2 ha) were treated and each treatment was repeated four times. This gave a total of 12 plots covering 24 hectares.

The first misting was carried out in November 1966, 8 months after the 1966 fire. The trial area was reburnt in November 1968, 2 years after the initial chemical treatment. This fire gave a good, clean burn and reduced all suckers to ground level. The area was misted again in April 1969 using the same treatments on the same plots as the first misting. This gave two burning treatments—1. Burnt, misted, burnt, misted. 2. Unburnt, misted, burnt, misted.

Permanent quadrats, that is, permanent sample areas, 20 m long by 1.5 m wide were pegged out in areas of burnt and unburnt suckers in each plot before the first chemical treatment. Counts were made of the number of suckers in each of the quadrats before the first misting, 2 years after that misting (immediately before the second misting) and again 18 months after the second misting. This allowed separate assessment of the effects of the first misting, the fire between the two mistings and the second misting.

## Results

There was little difference between the chemical rate and carriers, although the 1.12 kg a.e. per hectare in distillate was slightly superior to the other two. However, where the suckers were burnt before the first misting, the result of that misting was three to four

times better than that achieved on the old, unburnt suckers. After reburning, however, the second misting tended to even out the results for all treatments with the poor kills on the unburnt suckers from the first misting jumping to 75% to 80% kills. The kills on the plots burnt before both chemical treatments were in the 90% to 100% range after the second misting.

The results are shown in the accompanying histogram.

## Conclusions

Burning before misting brigalow suckers can markedly increase the kill. However, caution must be exercised. Following burning, the emergence of suckers can be very erratic and care must be taken to ensure that the burn is properly timed.

Careful observation is needed to determine that all the suckers that are going to emerge have, in fact, emerged. This usually takes a minimum of 4 months after the burn. Provided these precautions are taken and the conditions are suitable, full advantage can be taken of burning.

Where it is impossible to burn before chemical treatment, through density of suckers or lack of fuel, a misting followed by burning 1 to 2 years later and respraying is a very good alternative. The burning can be carried out 10 months or more after misting, but is best left for a couple of years to let the ground trash build up.

Misted suckers do not burn well in the first year after treatment but will burn satisfactorily in the second autumn-summer period after treatment.

The rate of 2,4,5-T ester and the carrier used should be:—

0.75 to 1.0 kg a.e. 2,4,5-T in 40 to 50 litres distillate per hectare

or

1.0 to 1.25 kg a.e. 2,4,5-T in 40 to 50 litres water per hectare.

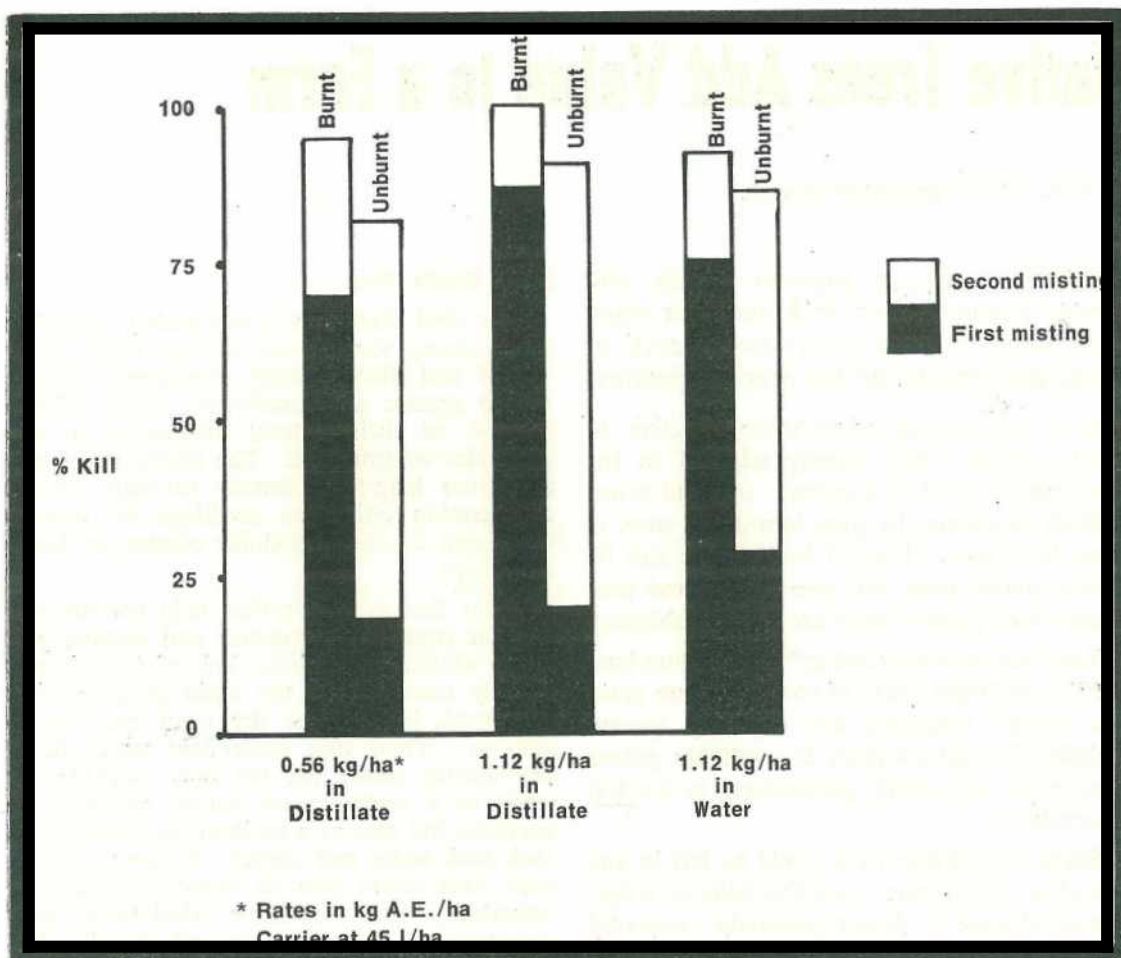
For mixing the above use:—

1.0 to 1.25 kg of 80% a.e. 2,4,5-T ester in 40 to 50 litres of diesel distillate per hectare

or

1.25 to 1.50 litres of 80% a.e. 2,4,5-T ester in 40 to 50 litres of water per hectare.





Burning should be carried out in the October-December period and misting from February to May provided soil moisture is high and the plants are growing vigorously.

If, because of drought or some other factor, misting cannot be carried out in the same season following burning, it can be delayed until the following summer. Misting can then be undertaken as soon as soil moisture is adequate.

Some grazing is usually needed before misting to remove any grass that may be shielding the suckers. In the trial, the area was grazed heavily until about 3 to 4 weeks before misting. Stock should be removed a few weeks before treatment to allow any damaged suckers to grow again.

### Caution

It is known that 2,4,5-T can be harmful to fish. Contamination of dams and watercourses should be avoided.

In using ester formulations, particular care should be taken to avoid the drift of spray droplets or of vapour given off by treated plants after spraying is completed onto susceptible crops such as cotton, sunflower, safflower, lucerne and pasture legumes.

The weedkiller is non-poisonous to live-stock, but stock should be kept out of treated areas for at least 2 weeks if poisonous weeds, such as variegated thistle or mintweed are present. These weeds sometimes become palatable to stock after treatment.

# Native Trees Add Value to a Farm

by T. K. KELLY, Agriculture Branch.

ENOUGH trees to provide shade and shelter should be left in a paddock when it is being cleared of brigalow scrub or forest and developed for crop or pasture.

It is easier and much more effective to ensure enough trees already adapted to the environment are left standing. It could prove difficult to attempt to grow introduced trees at some later date. Even if better trees can be grown, native trees will give the desired protection until planted trees are fully established.

Trees are necessary not only for pasture land but also in larger tracts of country where grain and forage sorghums are regularly grown. Stubble of grain sorghum is profitably grazed after grain harvesting, particularly in Central Queensland.

Shade and shelter trees could be left in any one of several forms: fence line belts or strips, central clumps in larger paddocks, scattered clumps or individual trees in smaller paddocks and individual trees just outside the fences of small yards. With brigalow scrub that is pulled, fired and sprayed with hormones after regrowth, it is probably easiest to retain a fence line strip.

In bigger paddocks, central large clumps reduce walking distances for stock. Central clumps also enable stock to obtain protection on their leeward side regardless of the direction of a wind. Individual trees are best suited to small paddocks and a number of small scattered clumps to medium sized paddocks. Small yards can be sheltered without loss of space by siting the trees just outside the yard and ensuring that their branches spread over the fence.

## Ideal Shade Tree

The ideal shade tree is one with a spreading habit, strong, tough wood that can resist heavy winds and fairly dense, evergreen foliage. Native species are usually the most reliable because of their natural adaptation to the particular environment. The ability of species to ensure long-term density through natural regeneration either as seedlings or suckers must also be considered for clumps or fence line strips.

Trees that grow together help protect one another from harsh weather and storms, yet, for a windbreak, a dense belt of trees is not entirely necessary as the main purpose of a windbreak is to break the wind and not to stop it. Trees that grow near water holes or watering points are not only valuable for stock as a resting point before returning to pastures, but also as a harbour for birds which seek both water and shelter. To some extent, such trees could also be expected to protect waterholes from excessive wind-borne dust depending on their location and the direction of the prevailing winds.

Little grazing is obtained by clearing trees from rocky outcroppings on a property and these areas can be set aside for additional shade and shelter. Trees should also be retained along gullies subject to erosion and on steep slopes that could erode after clearing. The root system of a tree plays an important part in stabilizing the soil.

While stock can damage young trees, fire is the main hazard and should be guarded against by providing fire lines around them as an important part of property management.

It is difficult to assess the true value of trees on a property but there is little doubt that, when a sale is being considered, a prospective buyer is attracted by well-sited and well-maintained shelter trees.





### Storing Cheese In Your Home

*EVERY variety of cheese, irrespective of type, needs the best possible storage conditions to maintain its keeping quality.*

Cheese generally is at its best when first brought home, and subsequent storing and handling will determine the quality that may be expected from it.

Cheese is a biochemical product in which changes are occurring all the time. In the harder cheeses, this reaction is slower than in soft varieties, and therefore these cheeses keep longer. Because of this constant change, cheeses need protection from heat, light and air. Refrigerated storage is perhaps the most important requirement.

Modern household refrigerators are equipped with special dairy cabinets that maintain temperatures from 7 to 10° C (45 to 50° F). At these temperatures, chemical changes are controlled to produce normal maturing characteristics. If cheese is subjected to abnormally hot conditions, the surface becomes greasy and unsightly with fat residues.

Protection from light is needed to prevent the development of flavour defects such as rancidity or oxidized flavours.

Exclusion of air ensures freedom from mould, and prevents the cheese from drying out. This is a common fault of incorrectly protected cheese.

Therefore, it is good practice to always wrap cheese in foil, polythene film or waxed paper, or perhaps to store it in a suitably covered jar or container before placing it in the refrigerator. If the cheese has a strong aroma, the advantage of doing this is self-evident. Where cheese is sold in lidded containers, the lid should be replaced immediately after use to keep the cheese's flavour and quality.

Generally, it is better to buy cheese frequently than to attempt to store large quantities for long periods, and manufacturers are aware of this need. The cheeses now are packed in a variety of sizes from small wedges to a 10 lb. (5 kg) block. Individual portion packaging, which is well established now, means that consumers can buy fresh products of the desired size with a minimum of inconvenience.

Many new varieties of cheese are available and each has its own particular flavour. It is important to know how to get the best enjoyment out of them. Useful information about many varieties of cheese and their uses can be obtained from the Australian Dairy Produce Board's Information Centre, North Quay, Brisbane, Q., 4000.

—I. J. MCKENZIE, Dairy Technologist.



### Home Hints

On car trips, carry cordial or water bottles in a milk bottle holder with plastic beakers in one section—handy, and much less chance of spilling.

An extra mirror lower down on the bathroom wall will encourage young children to brush their teeth and keep tidy.

For a tasty lunch, cut tops off two large tomatoes and scoop out centre. Season. Drop an egg in each tomato. Pile in seasoned centre and top with grated cheese. Bake in moderate oven for about 20 minutes.

Stick a sheet of foam plastic on shelves in the caravan and those saucepans and tinned goods will not slide around.

To test temperature of an oven that you suspect is faulty, give a piece of white paper the 3-minute test. Place it in the hottest part



of the oven for 3 minutes. A hot oven will turn the paper a good rich brown colour. A moderately hot oven will turn the paper a light brown colour and a slow oven will turn the paper yellow, or it may just stiffen and not colour.

To keep sweet corn tender during cooking, do not add any salt to the water. Cook for 15 to 20 minutes. Try cooking the corn in half milk and half water and use the liquid for the stock in making the sauce.

Vanilla sugar is easy to make and very useful to have in the kitchen. Place castor sugar in a storage jar and stand a vanilla pod inside. The sugar absorbs the flavour and, when using in cakes or biscuits, do not add vanilla essence, use the vanilla sugar instead.



### **Bringing Home the Baby**

The new baby is wonderful, a brand-new little person you and your husband have eagerly awaited for the past 9 months. You're anxious to take him home, and let his brothers and sisters share the joy you feel in his arrival.

That's fine. But remember, unless you've carefully paved the way for the coming of the baby, the other children may show considerably less joy in having him around.

The wise expectant mother will have prepared for this time by allowing the rest of the family to share the waiting time. If they feel they are included in the 'secret' of the

coming baby, most children will be interested and happy about it. They should not be given the impression that the newcomer will supplant them in the affections of their parents.

In spite of all preparations, a few children show extreme reactions to the idea of having a new baby in the house. Some may revert to 'babyish' behaviour in an endeavour to 'win back' mother's attention. This regressive behaviour may even include bed-wetting. In such cases, inclusion in as many as possible of the tasks mother performs for the baby, bathing, feeding and taking for outings, will do much to reassure an insecure child.

An isolated case of rebellion among teenagers stems, not from a dislike or fear of the baby, but from a feeling that it is not quite right or nice for mother and father to be involved in the activities required to produce a baby. It is probably wisest for parents just to behave naturally, and ignore the inference that they are 'too old'. Time, and the teenagers' own maturity, will usually mellow any antagonistic feelings.

For younger children, a pregnancy affords an ideal opportunity to begin basic sex education. It is not wise or desirable to fob off questions about the coming baby with answers like 'the stork will bring him', or 'we'll find him under a cabbage'. Factual answers, simply told, will lay the foundation for a healthy attitude toward sex and reproduction.

With proper preparation, bringing home a new baby can be a joyous event, shared by the whole family, just as it should be.

—Queensland Health Education Council



**pure new wool**



# Treats for Sunday Night Suppers

*AUSTRALIANS enjoy their weekend outings and this is the time when easy-to-prepare snacks are the order of the day.*

It is a time when the cook likes to relax, too, so these three recipes made with economy Australian beef mince, or other cuts, are ideal for any Sunday night.

Expensive beef cuts are not necessary for these appetising dishes and they will feed adequately an average sized family after a weekend in the country or on the beaches.

These three recipes have been kitchen-tested by Tess Mallos, Food Consultant to the Australian Meat Board. The Australian standard metric cup and levelled spoon measurements are used in the recipes.

## Hero Burger

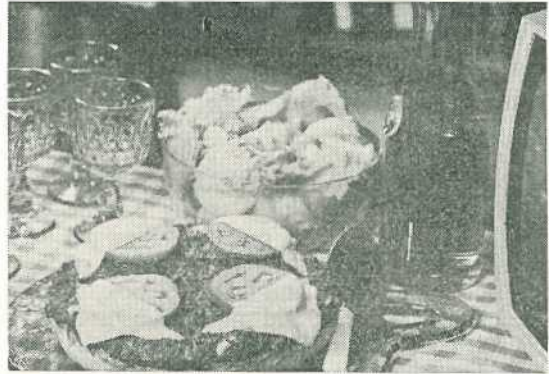
### INGREDIENTS

- 350 g ( $\frac{3}{4}$  lb.) minced beef
- 1 small onion, chopped
- 1 tablespoon Worcestershire sauce
- 2 teaspoons prepared mustard
- 1 teaspoon grated horseradish
- $\frac{1}{2}$  cup concentrated tomato soup from can
- $\frac{1}{2}$  teaspoon salt
- Pepper to taste
- Cheese and tomato slices
- Loaf of bread (Cottage, Vienna or similar)

**METHOD.** Mix together beef, onion, Worcestershire sauce, mustard, horseradish, soup, salt and pepper.

Slit bread loaf in two and keep one half for later use if large (wrap and store in freezer); use both halves if small. Lightly toast bread under griller on cut surface only.

Spread meat mixture on toasted bread, taking it to the edge. Cook under griller for 12 minutes. Arrange cheese and tomato slices



**TOP.** This tasty Hero Burger is a man-sized meal for all the family. Prime Australian minced beef topped with juicy tomato slices and delicious Australian Cheddar cheese appeals to every taste. Easy to prepare, it makes an ideal end to an outdoor weekend.

**BOTTOM.** Capsicum Beef Oriental is another easy-to-prepare dish made from Australian beef. It gives just that touch of the exotic to round off a pleasant day at the beach.

on top and return to grill until cheese melts. Serve in wedges with crisp salad vegetables if desired. Serves four to six.

### **Capsicum Beef Oriental**

#### **INGREDIENTS**

1 slice round steak (about 350 g or  $\frac{3}{4}$  lb.)  
3 tablespoons oil  
1 large onion, sliced or coarsely chopped  
 $\frac{1}{2}$  cup celery, thinly sliced  
1 cup sliced mushrooms  
 $\frac{3}{4}$  cup beef stock  
1 tablespoon soy sauce  
2 tablespoons dry sherry  
2 teaspoons cornflour  
Hot, boiled rice.

**METHOD.** Cut beef into long, thin strips. Heat 2 tablespoons oil in large frying pan or wok and brown meat strips quickly. Remove to a plate as they brown. Add remaining oil and add onion, capsicum and celery. Cook, stirring often, for 5 minutes; add mushrooms and cook for further 5 minutes. Mix liquids with cornflour and stir into vegetables. When thickened, allow sauce to bubble for 2 minutes. Return meat to pan and heat gently without allowing mixture to boil. Serve with hot, boiled rice. Serves four to six.

### **Pizza**

#### **INGREDIENTS**

250 g ( $\frac{1}{2}$  lb.) minced beef  
2 tablespoons oil  
1 onion, chopped  
1 cup chopped, peeled tomatoes

1 tablespoon tomato paste  
 $\frac{1}{4}$  cup water  
Salt and pepper to taste  
1 teaspoon sugar  
 $\frac{1}{2}$  teaspoon dried basil  
 $\frac{1}{2}$  teaspoon dried oregano  
1 green capsicum cut in strips  
Pitted black olives  
Sliced Mozzarella or cheddar cheese  
Olive oil  
1 quantity scone dough using 1 cup flour or 1 cup packaged shortcrust pastry mixed according to directions.

**METHOD.** Brown mince in 1 tablespoon oil and set aside. Sautè onion in remaining oil until golden. Add tomatoes, tomato paste, water, seasoning, sugar and herbs. Cover and simmer gently for 10 minutes while you make scone dough or pastry. Set oven temperature to 220°C (425°F).

Roll out scone or pastry dough thinly to fit 30 cm (12-in.) Pizza pan (or roll out to this size, place on a greased oven slide and form a rim around edge of dough to contain topping).

Spread dough with tomato sauce and sprinkle on browned mince. Arrange halved olives, capsicum strips and cheese on top. Sprinkle all over with olive oil and cook in pre-heated oven for 15 to 18 minutes until crust is cooked. Serve cut into wedges. Serves four to six.

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## **Care of eyesight**

EYESIGHT is precious. Always wear safety goggles when performing tasks where chips or splinters of wood or metal are likely to fly; where corrosive liquids may splash; or where any foreign substance may accidentally enter the eye.

—THE QUEENSLAND HEALTH EDUCATION COUNCIL



# Two Leaf Diseases of Maize

## Turcicum leaf blight

TURCICUM leaf blight (*Drechslera turcica*) is one of the most widespread and frequently occurring diseases of maize in Queensland. It is generally more severe in the coastal areas but may be quite serious in inland districts if prolonged wet weather occurs.

### SYMPTOMS

Turcicum leaf blight may be recognized by the long, spindle-shaped leaf spots which extend along the leaves. These are at first greyish-green and water-soaked in appearance but later become light-brown or grey in colour. Spots are often up to 150 mm long but seldom more than 25 mm wide. This distinguishes it from maydis leaf blight caused by a related fungus *Drechslera maydis*, which produces small spots rarely more than 10 mm long and 5 mm wide.

As turcicum leaf blight progresses, spots may coalesce to cause a blight of almost the entire leaf surface. Under moist conditions, dark-grey masses of spores are produced on the spots.

The disease first occurs on the lower leaves and progresses up the plant. Usually symptoms are not obvious until after tasselling when the plant approaches maturity. However, under wet conditions, infection may occur quite early and severe blight occurrences at this time may seriously reduce yields.

### SPREAD

The spores that produce the primary infections in a crop originate on old, infected leaves in the crop trash on which the fungus overwinters. The disease is then readily perpetuated by the abundance of spores produced on spotted leaves. The causal fungus is favoured by humid, cloudy and relatively warm conditions, and the spread of the disease from plant to plant occurs readily during showery weather.

Sorghum is also susceptible to turcicum leaf blight and neighbouring fields of this crop may provide a source of the disease.

Volunteer maize and sorghum plants provide an opportunity for a quick build-up of the fungus early in the season.

### CONTROL

Maize hybrids vary in their susceptibility to turcicum leaf blight. Generally, early maturing hybrids are more susceptible than medium or late maturing ones. Details of hybrids recommended for each maize-growing area are published annually by the Department before the beginning of the season. This information will assist growers in avoiding susceptible hybrids.

Crop rotation is also important in controlling the disease by keeping new crops away from the trash of diseased crops from the previous season. Volunteer maize and sorghum plants should also be destroyed wherever possible.

## Common rust

COMMON rust (*Puccinia sorghi*) is one of two rust diseases which have been recorded on maize in Queensland. It has been widespread and well known for many years but has not been regarded as a major cause of yield loss.

In the 1958-59 season, a new rust disease, tropical rust, caused by *Puccinia polysora*, appeared on the Atherton Tableland and has since proven to be a serious disease in seasons when weather conditions have favoured its development. However, it has not yet been recorded in southern Queensland.

### SYMPTOMS

Common rust produces large, oval to elongate, reddish-brown pustules, or rust spots, which occur unevenly in scattered groups over the leaf surface. Often the leaf tissue around these groups of pustules dies, giving rise to a scattered leaf spotting. No rust spotting occurs elsewhere on the plant.

Common rust may be distinguished from tropical rust by the fact that leaf pustules of tropical rust are comparatively small, round, abundant and relatively uniformly distributed over the leaf surface. In addition, midribs, leaf sheaths, ear husks and tassels may be affected.

### SPREAD

The large numbers of spores produced by common rust are spread readily by air currents and initiate new outbreaks particularly during warm, humid weather. Volunteer maize plants may provide a source of the disease early in the growing season.

### CONTROL

Generally, common rust appears only when crops are approaching maturity, so yield losses are not considered to be sufficiently high to justify the development of resistant hybrids. However, removal of volunteer plants and crop rotation are recommended for minimizing the build-up of this and other maize diseases.

— Plant Pathology Branch

Further information can be obtained from the nearest Plant Pathology office or by writing to the Director, Plant Pathology Branch, Department of Primary Industries, Meiers Road, Indooroopilly, Q. 4066.

# Diseases of Maize – 3



*Turicum leaf blight*



*Common rust*